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ABSTRACT

This paper reports the formative evaluation of six curriculum units related to initial number sentence writing. These units were used for a coordinated study carried out by the Mathematics Work Group of the Wisconsin Research and Development Center for Individualized Schooling. The units were tried during the 1977-78 and 1978-79 school years at a single elementary school located in Madison, Wisconsin. Information, including in-class observation, reports from teachers, pupil assessment, and notes from pupil comments, was gathered from trying the materials on about 50 children through their first and second years of elementary school. The information is summarized by topic or unit and suggested revisions are stated. Copies of the newly developed units are contained in the Appendix to the report. (Author/MK)

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Technical Report No. 522
Part 1 of 2 Parts

Development and Validation of Curriculum Units Related to Initial Sentence Writing

by
Vicky L. Kouba and
James M. Moser

Wisconsin Research
and Development Center
for Individualized Schooling

October 1979

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Technical Report No. 522

Part 1 of 2 Parts

DEVELOPMENT AND VALIDATION OF CURRICULUM UNITS RELATED TO INITIAL SENTENCE WRITING

by

Vicky L. Kouba and James M. Moser

Technical Report No. 2 of
the Studies in Mathematics Series

Report from the Project on
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CENTER FOR INDIVIDUALIZED SCHOOLING

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Abstract

This paper reports the formative evaluation of six curriculum units related to initial sentence writing. These units are used as the instructional units for a coordinated study carried out by the Mathematics Work Group of the Wisconsin Research and Development Center for Individualized Schooling. The units were tried during the 1977-78 and 1978-79 school years at a single elementary school located in Madison, Wisconsin.

Information, including in-class observation, reports from teachers, pupil assessment, and notes from pupil comments, was gathered from trying the materials on about 50 children through their first and second years of elementary school.

The information is summarized by topic or unit and suggested revisions are stated. Copies of the newly developed units are contained in the Appendix to the report.

Introduction

A major aim of mathematical instruction is to enable students to acquire concepts and skills requisite for solving problems of many types. A principle goal of mathematical education research is to understand how children acquire those concepts and skills and to understand how selected pedagogical and psychological factors are related to that acquisition. The Mathematics Work Group of the Wisconsin Research and Development Center for Individualized Schooling is presently conducting a program of research focused on a small set of those concepts and skills. Its interest lies in arithmetical learning, and in particular, in the acquisition of concepts and skills related to addition and subtraction of whole numbers.

The research program is attempting to relate pupil performance on selected arithmetic skills to the factors of pupil cognitive processes, instructional materials, and teachers' classroom behaviors. The interrelationship of these variables is depicted in Figure 1.

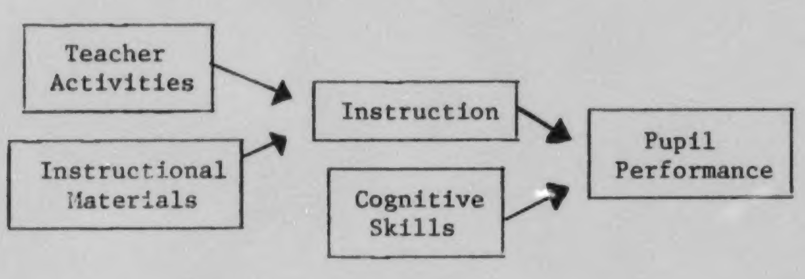


Figure 1. Factors influencing pupil performance

Using this framework, we are proceeding

1. to identify important addition and subtraction skills,

2. to review past empirical data or collect new data on these skills;
3. to re-examine these mathematical skills and hypothesize how underlying cognitive skills are related to these skills;
4. to examine the instructional materials designed to teach these skills; and
5. to conduct a series of empirical studies on the appropriateness of particular teacher classroom behaviors, the appropriateness of instructional materials, and the relationship of specific cognitive skills to mathematical skills.

The work being carried out by the Mathematics Work Group is built around the conceptual framework exemplified in Figure 1. The empirical and theoretical investigations being conducted generally involve two or more of the factors depicted above, and have been organized into four major categories. These are a Conceptual Paper series, a set of short Empirical Studies, a major Longitudinal Study, and an Invited Conference of Scholars.

This paper has as its purpose the presentation of data related to an aspect of the Longitudinal Study. This study has two subdivisions, the first (Coordinated Study #1) being aimed at the study of the acquisition of more formal algorthmic procedures. Approximately 150 students in three separate schools have been identified as subjects and are being followed for about three years. Pupil performance will be measured in several ways:

1. Individual interviews. At several times during each school year, individual children are administered a set of problem tasks dealing with addition and subtraction. The interviewer attempts

to ascertain the solution strategy used as well as correctness, type of error if one is made, and modeling procedures.

2. Group administered paper-and-pencil tests. There are two separate categories of tests.
    a) Achievement monitoring. These tests measure pupil progress towards a set of performance objectives that are contained in the instructional materials. By means of matrix sampling procedures, estimates are made of group performance. Achievement monitoring tests are given several days after the completion of the instructional units that are related to arithmetic objectives.
    b) Topic inventories. These are very short tests that measure pupil progress towards mastery of the objectives of a specific instructional unit, or topic. Every subject takes the same test and so a measure of individual performance is obtained.

Instruction is assessed by observing teacher actions, pupil behaviors and instructional materials. These are recorded by means of direct classroom observation. A trained observer is present each day of instruction during the period when the instructional units, or topics, dealing with arithmetic objectives are being used. Organizational and grouping measures are noted together with indications of interactions between teacher and pupils, and between pupils and pupils. Six target students are also observed for measures of engaged time.

The purpose of this report is to describe the development of the curriculum materials used in connection with Coordinated Study #1. Developmental procedures paralleled those used in production of Developing Mathematical Processes (DMP) (Romberg, Harvey, Moser, and Montgomery, 1974, 1975, 1976). The authors set instructional goals, analyzed content and methodology, wrote prototypic materials, observed and analyzed classroom implementation, and then prepared revised materials.

Population

The data reported here were gathered from Our Lady Queen of Peace School, a relatively small parochial school located in a middle-class section of Madison, Wisconsin. The primary unit teachers of that school conducted the lessons. Altogether, 4 teachers, 2 student teachers, 1 aide, parent volunteers who help with classroom and material management, and 50 students participated in the tryout of the curriculum materials during the academic years 1977-78 and 1978-79.

Two classrooms of children were involved in the observation and tryout. One class, identified as Class A, was comprised of children who were identified as average or above (by the teachers). Class B was comprised of children who had been identified as average or slightly below.

Classrooms were visited one to four times a week, but no specific observation schedule was followed. The purpose of the observation was two-fold: to provide an informal summary of children's mathematical skills and development and to record classroom implementation of the experimental topics.

The students completed two of the six curriculum units, or topics as they are called in this report, when they were first-graders during the 1977-78 school year. The remaining four topics were completed by the students as second-graders during 1978-79.

Curriculum Materials

The regular curriculum used for mathematics instruction in the tryout school is DMP. In first grade, DMP Topics 15 through 27 are ordinarily taught. The two experimental topics used in this study at the first grade level replaced Topic 25, Representing Equalizing Situations, and Topic 27, Representing Other Equalizing Situations. In second grade, DMP Topics 28 through 38 are ordinarily taught. The four remaining experimental topics replaced Topic 29, Representing Joining and Separating Situations, Topic 32, Solving Number Sentences 0-10, and Topic 35, Number Sentences 0-20.

The basic structure and design of the experimental topics closely resembled the regular DMP materials. Thus, the teachers and children were not required to adjust to different language, terminology, symbolism, or patterns of classroom organization.

The major objective of the sequence of six topics was to develop the ability to solve problems in addition and subtraction that are reasonable for first and second grade children. We consider a problem to be reasonable if its wording and structure are such that most children will be able to successfully subject the problem to the following procedure:

1. Analysis of the relationships between the parts of the problem. The end result is to represent these relationships with either a horizontal or vertical number sentence of the form $a + b = \square$

$\left[\begin{array}{r} a \\ \underline{+b} \end{array}\right]$ or $a - b = \square$ $\left[\begin{array}{r} a \\ \underline{-b} \end{array}\right]$

2. Solution of the resulting mathematical sentence by any reasonable means, but preferably by recall of a basic addition or subtraction fact.

The underlying rationale for the analysis phase rests on what is called the part-part-whole relationship (see Moser, 1979 for greater detail). In this relationship one considers some whole object or set that can be broken up into two distinct parts according to some identifiable rule, action, or description. Assuming that numbers can be assigned to the whole and to its component parts, the analysis proceeds by following one of these numerical relationships:

i) If one knows the two parts, then add their corresponding numbers to find the size or number corresponding to the whole. Briefly stated this relationship is:

   part + part = whole.

ii) If one knows one of the parts and the whole, then subtract the number corresponding to the part from the number corresponding to the whole. Briefly stated this relationship is:

   whole - part = other part.

Finally, the analysis phase comes to the crucial step of being able to take a particular problem and decide whether the two known objects or sets are the two parts (in which case one adds) or are the whole and one of its parts (in which case one subtracts).

The other major focus of the six-topic series is the acquisition of basic computational facts. In the earlier topics the majority of attention is given to small numbers and simpler facts with a progression toward the harder facts.

In the sections that follow, each of the six topics will be discussed in detail. Copies of all instructional materials are presented in Appendix A.

Report on Topic S-1, Initial Sentence Writing

This section begins with an overall description of the content of Topic S-1. This is followed by short summarizations of the seven instructional activities that make up the topic. The tryout of materials is reported and discussed in chronological order for each class. The two teachers involved in the tryout taught the topic independently and at different times. The transition from one activity to the next did not always occur at the end of a particular teaching period.

Overall Description of Topic

Topic S-1. The symbols "+" and "-" are introduced within the context of joining and separating. Children learn to interpret situations as additive or subtractive within the joining and separating context only. They indicate their interpretation by writing "+" or "-." Then they write binary phrases and finally a complete open sentence to represent a situation. Sentences are of the form $a + b = \square$ or $a - b = \square$. No formal method for solving the open sentences is prescribed at this time, nor is memorization of facts encouraged.

Activity A. In preparation for introducing the + and - signs and for writing mathematical sentences, this activity reviews joining and separating. The children verbalize what they are doing.

Activity B. In this activity the children are introduced to the + and - symbols. They choose or write the symbol that describes the joining or separating situation.

Activity C. In this activity the children choose or write phrases to represent joining and separating situations.

Activity D. In this activity the children practice writing phrases that represent joining and separating situations, as well as solving those problem situations. In this activity numerousness is used.

Activity E (Optional). In this activity the children practice writing and solving phrases that represent joining and separating situations. The situations involve some measurement (length and weight).

Activity F. In this activity the children are introduced to writing mathematical sentences ($a + b = \boxed{}$) to represent joining and separating situations. They also solve sentences.

Activity G. This activity gives children additional practice in writing open sentences about joining and separating situations.

Report on Topic S-1

Class A

April 3, 1978

Returned papers on counting patterns, numbers 0-100.

Patterns were counted by 2's, 5's, and 10's. Not part of DMP.

Discussed errors.

Handed out materials and introduced "Chain Change," page 2.

Discussed organization of page and where to record answers.

Played four rounds of "change." The teacher allowed plenty of time and checked each child's work.

The teacher let the children draw links to be added on or taken away.

Comments

The chain change page turns out to be more of a counting exercise than an adding or subtracting one. Children were excited about doing both joining and separating. The teacher discussed the overall change in the chain (when adding on the chain gets larger; when taking away the chain gets smaller). She also asked the children if the change would be large or small depending on the number of links to be added or subtracted. (Recommend by the observer that the number of links in the chain be recorded on the page.)

For the second round the number began with the same number that ended the first round. One girl called the observer over to her desk and said, "Look at this. Something's strange. I started with 9 and he started with 8 and then all of a sudden our numbers are the same. That's strange." "What do you think happened?", the observer asked. "I don't know, but it isn't right. Somebody must have goofed somewhere."

April 5, 1978

Discussed page from previous day and introduced page 4. Children worked individually on page 4. Aide and teacher checked children's work. Went on to page 5. Teacher continually suggested using links to solve, and discussed methods of getting answers on pages 4 and 5 with those children who were finished. Discussed words:

Teacher asked what children thought "Add" meant. On child said, "Put some more on."

Another child said, "Get out my calculator and start working."

For "take away," the children answered "take some things away." For "go away," they said, "something leaves." Teacher pointed out that "add" and "more" are connected or are cousins, and "take away" and "go away" are cousins.

The teacher started Activity B by reading the story about Mr. D. Zine. Discussed what symbols the children had seen or written. Children suggested ¢, $, and ≠. The children wanted to write ≠ for +, initially. They did the stories with no difficulty.

April 6, 1978

Reviewed signs: +, -.

With +, or "add on," the teacher emphasized that things get bigger.

For - or "take away," things get smaller.

Distributed page 6 and discussed the layout of the page, where and how to record, etc., and the first problem. Most children thought that the first problem was about "add on." The teacher said they had to be detectives. Then one girl said, "Oh, no, it's take away. I can tell by the dots on the giraffe." They discussed the second problem. The children had no difficulty with it.

Children completed pages 6 and 7, then corrected the pages.

Distributed page 8 and did the first two problems.

Children worked individually on pages 8 and 9. Had no problems.

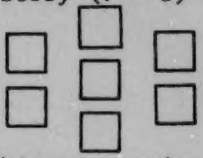
Corrected pages 8 and 9. This took a long time because the problems weren't lettered or numbered, and the children and teacher were confused about which problem they were correcting.

Teacher had the children count by 2's, 5's, and 10's as they lined up.

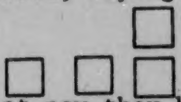
April 7, 1978

Started Activity C. The teacher read the story to the children. She explained that 4 - 3 is part of a number story called a "phrase." A phrase isn't a whole story because there is no ending. They did the stories from the teacher's guide, using the flannel board to help solve the problems.

Example: For the first story (7 - 3) a boy placed seven objects on the board.

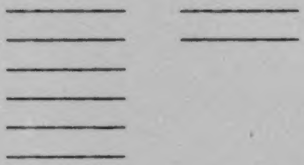


A second boy removed 3 objects, saying there were 4 left.



The teacher pointed out that now they had an ending for their story. She asked if anyone could tell the whole story. The children answered, "Seven take away three equals four." They used the word "equals" with no prompting or directing from the teacher.

Example: "6 stripes, wants 2 more." One child went to the chalkboard and wrote 8. The teacher explained she didn't want the answer; she wanted instructions to give the machine. She put the following sets of marks on the board:



Then she asked whether they would end up with more or less stripes?

Boy: "Less?"

Teacher: "Do we?"

Boy: "No, more, because there's 8 altogether."

Boy then wrote 6 + 2.

Distributed page 10. Discussed what "instructions" are. The teacher had each child give an example of instructions parents might give: "Close the door," "Hang up your clothes," etc. Then they discussed number instructions. The teacher asked, "What about 2 - 4?" She showed the children with objects that it didn't make sense. If you only have 2, you can't take 4 away.

The teacher distributed page 11 and expained it. She suggested that for one story they could write either 6 + 4 or 4 + 6. She wanted to know why it was possible. The children announced, "oh, that's the same, just the other way around." The teacher summarized, "In adding on, the numbers can be switched around. In taking away, they can't." The children did page 11 individually.

Comments

It appears that less time needs to be spent at the phrase stage. The teacher said the term "phrase" might be too difficult for slower students.

April 10, 1978

Started Activity D. The teacher passed out page 12 and explained how to record. One boy was very upset that the class would be doing the page together. Finally he asked, "Why do we always have to do sheets together?" The teacher answered, "We don't always. Last week we did many pages as fast as we wanted." This seemed to satisfy him.

Passed out cubes to "show" problems. They discussed what a workshop is and what might be found in a workshop.

Did example (15 - 7), no problems. Did the 10 stories. The teacher directed this and checked problems as they worked. For the first few problems she told them when and how to write the phrase.

Observer returned to the boy who had not wanted to do the page together. On the page were the problems 6 + 7 and 4 + 9. Observer asked him how they could both equal 13. He answered, "I know they do. I looked at that [pointed to 6 + 7 then pointed to 4 + 9] and if you take 2 from 9 and put it with the 4, you get 6. Nine take away 2 is 7, so it's the same as 6 + 7."

April 12, 1978

Started Activity E. The teacher described what the children were to do at the weight stations. They reviewed page 14 in preparation for 15 and 16, noting what was meant by "make N" or "make K." Part of the class finished page 14 and started on 15, while the rest weighed as directed on the top of page 16. Then they reversed assignments. The children seemed to have no problems weighing. One girl was weighing a ball of clay and the balance would not stop exactly parallel on either 4 or 5 washers. She left 4 washers on and moved the clay ball until the balance was exactly parallel. Two problems began with the instructions, "make A." The children had difficulty realizing that, for the second problem, they were to begin with A as it first had been measured, not as it had been changed in a previous problem.

April 18, 1978

Started Activity F. The teacher reviewed add on and take away phrases with the children. Then they discussed the meaning of "equal." The children counted and did one-to-one matching on the board to show that two sets of objects were equal. The teacher used the flannel board for representing stories to introduce writing sentences. The children wrote the phrase, then the answer, and then put in the equal sign rather than writing $9 - 6 = \square$, and then solving. The children went back to page 12 to write the equal signs and to read the sentences. There were no problems with reading. Discussed page 18. The children circled and solved sentences. There were some problems with children circling $4 - 7 = \square$ rather than $7 - 4 = \square$, but when asked to represent the sentence with objects, most children concluded 4 - 7 didn't make sense. The teacher stressed using objects to solve and validate--to the exclusion of other solving strategies.

April 20, 1978

Started Activity G. The teacher reviewed the three problem solving steps she introduced the day before:

1. Decide if it is + or -.
2. Write the phrase.
3. Solve it.

The teacher explained that before solving each problem, the children had to write $= \boxed{}$.

For example, $9 - 6$

$9 - 6 = \boxed{}$

$9 - 6 = \boxed{3}$

The children played the game from Activity G.

The teacher discussed the sentences the children had written and solved during the game.

Comments

Class A finished Topic S-1 on April 24th. The teacher thought it had gone well, but that it might have been too easy for the children. She thought there should be more time spent writing sentences and less time writing phrases. She also thought there should be counting by 2's and 5's.

It appeared that once the teacher stressed using objects, the children were hesitant about other methods. When the observer discussed this with the teacher, she said that she thought we wanted the children to solve only with objects. She said she would encourage other methods on the next sentence writing topic.

Class B (Most children had poor concentration and classroom behavior.)

April 11, 1978

Started Activity A. The teacher discussed the meaning of "change." Many children volunteered the "money" definition. The teacher showed a chain of links and had the children count them. Then she asked how she could change the chain. The children answered "take one off," or "put one on." The teacher did an example: The chain was 8 links long. She added 4 and asked what the length was now. She had the children count, "8 . . . 9, 10, 11, 12." As the children filled in the boxes on page 2, the teacher had to stress going across rather than going down.

The teacher did two more examples, and then explained the orientation of the page and handed out materials. As the children did the page many made counting errors and numeral reversals. They also misunderstood what box to use for recording. Two methods of changing were observed: (a) Adding or subtracting links one at a time. (b) Making a chain to be added and then joining that to the first chain, or counting the number to be subtracted and removing them as a group from the chain. At one point the teacher said, "Take six links and add them to your chain." Many of the children subtracted six links, evidently hearing the word "take" and deciding to "take away."

Worked as a large group with cards. For the card that said "10 take away 5" some children said immediately, "Oh, that'll be 5." The teacher didn't use the cards as directed, but adapted to this group's ability, making the activity a reading, counting, and solving exercise.

Returned and discussed pages on money (not DMP material).

April 17, 1978

Reviewed story from Activity B. Reviewed +, - signs. One boy wrote = for the minus sign. As a group they did the story problems, identifying them as + or -.

The teacher introduced pages 6 and 7, talking about how to record. She did the first two as examples and then the children completed the pages.

The teacher introduced pages 8 and 9 and the children completed them. When asked how he knew whether or not to write + or -, one boy said, "Just count. If it's less, it's take away. If it's more, it's add on."

The teacher started Activity C by reading the story. When the children wrote phrases, they confused the + and - signs. They seemed to be more concerned with the numbers than with the signs and often solved correctly even when they wrote the incorrect sign.

April 19, 1978

The teacher reviewed reading phrases and discussed previous pages.

Teacher: "No one circled 3 - 4. Why not?"

Children: "Because you can't take 4 away when there's only 3."

The teacher stressed reading from left to right. In subtraction phrases she pointed out that the bigger number must come first. She briefly reviewed addition and subtraction of zero: 0 + 7; 7 - 0. Then she began Activity D. The teacher introduced the stories. In the examples (and the problems) she didn't read the whole story. She read the first part (15 snaps in a jar) and had the children write "15." Then she read the next part (7 were used) and had the children write "15 - 7." Then she finished the story (How many snaps are left?) and told the children to solve using links. This created difficulties later with "inverted stories"--"7 snaps were used. There were 15 to begin with. How many were left?"

The teacher read the stories to the children, who wrote the phrases and solved. There was a great deal of teacher direction. The children were always instructed to use links to solve. In solving 4 + 9, the observer noticed one girl wrote $\boxed{13}$ immediately without solving by using links or counting.

Observer: "How did you know without using links?"

Girl: "Because I have a calculator at home and I did it once."

Observer: "And you remember?"

Girl: "Yeah!"

As the children listened and wrote phrases, they began to associate the word "used" with subtraction. Thus, they were confused when they heard, "He used 4 for a doll and he used 9 for a puppet. How many did he use altogether?" Most children thought it should be subtraction, but after writing 4 - 9, they decided something was wrong. Many children then wrote 9 - 4, but were not comfortable with that either. Finally the teacher reread the problem and discussed it with the children, telling them to write 4 + 9.

April 24, 1978

Reviewed page 14, Activity E, as a group. The teacher asked how the children proved they had the "true" or "right" answers. The children replied they used links, even when they "knew" the answer. The teacher also cautioned the children about number reversals.

The children finished page 14. The teacher read the problems to the children and discussed the phrases to be written.

Wrote the numbers 1-30 because many of the children are still reversing them. One boy who finished early went back to page 14. For one problem he had 8 + 0 = $\boxed{0}$. The observer talked to him about it:

Observer: "What about this one? Read it to me."

Boy: "Eight add on zero and zero's nothing so it's nothing."

Observer: "Can you show me?"

Boy: "Sure." (He laid out eight links.) "Add on nothing, so you write it zero but you don't do anything."

Observer: "How many do you have then?"

Boy: "Oh! Eight!"

Discussed answers to page 14 as a group.

April 27, 1978

The teacher set up materials for weighing and divided the class into two groups. She worked with one group (Group 1). The student teacher worked with the other (Group 2). For the rest of the period the student teacher's group (Group 2) finished page 16 (they had already done the weighing) and went on to page 17. The teacher read each problem to the children and talked with them about what phrases to write. The children solved with links.

Group 1 finished page 15. The teacher frequently reminded the children to write the number, not the letter, when instructed to "make A." The teacher read each problem to the children and discussed what phrase to write.

After the teacher demonstrated how to weigh, the children did the weighing for page 16.

Comments

This whole class refers to "phrases" as "sentences." The teacher and student teacher both believe this is better for the children than first learning phrase and later switching to sentence when the equal sign is written. Both also believe the children are not able to read and solve the problems without teacher direction.

May 1, 1978

Reviewed writing phrases (called them sentences). Then the teacher introduced the equal sign. They discussed:

Ex. A: 6 + 3 = □

Teacher: "Read this for me."

Girl: "Six take away three equals . . ."

Teacher: "Something."

Girl: "Something."

Teacher: "But, let's look at the sign."

Girl: "Oh, add on."

Ex. B: 4 - 2 = □

Some children thought the answer was 6; others said 2. The teacher solved the problem using links.

The children went back to pages 12 and 13 and wrote in the equal signs. The teacher had volunteers read each sentence. Some children were still confusing the + and - signs.

The teacher read stories and the children wrote sentences. Some children wrote $6 + 2 \boxed{8}$, others wrote $6 + 2 = 8$, and some misplaced the = sign entirely, $6 + 2 \boxed{8} =$. Most children counted links on one-by-one to solve.

At the end of the class period, the children worked on page 18.

May 3, 1978

The children finished page 19. They worked independently without having the teacher read and discuss each problem with them as a group. Many of the children still forgot or misplaced the equal sign.

The teacher explained the washer/pencil game. Many children, when asked, didn't know what to do, mostly because they didn't pay attention. The teacher persisted until the majority seemed to understand.

The children played the game. Some were still confused about when to write addition or subtraction sentences. One girl cried because she couldn't be with the partner she wanted and couldn't find anyone else to be her partner.

Comments

Class B was not observed for the remainder of S-1. The teacher reported that she did all parts, but the children still need much direction. By the end of the topic most children could write and solve sentences.

Report on Topic S-2, Sentence Writing: Part-Part-Whole and Difference

This section begins with an overall description of the content of Topic S-2. As with Topic S-1, the two experimental classes proceeded independently from each other. Class A, composed of the better students, worked on this topic from May 5 to June 2, 1978. Class B had weaker students and did not complete the topic before the end of the school year. Because of a late start on May 22, only the first four activities were covered by this class.

The report and discussion of the tryout of materials will be given in an activity-by-activity format, regardless of the number of days it may have taken to cover an individual activity. A short description of each activity will precede the activity results.

Overall Description of Topic

Topic S-2. Writing open sentences of the form $a + b = \square$ and $a - b = \square$ is presented again, this time stressing the representation of difference and part-part-whole situations. Again, no single formal method is emphasized for solving although different methods are presented. In the latter half of the topic, open sentences to be solved in a problem-free context are presented. Emphasis is on sentences with the numbers 0-6, in hopes that initial efforts at memorization will begin.

Activity A (Optional). This optional activity reviews writing and solving joining and separating sentences.

Class A: The children had no difficulties. The teacher reviewed the three solving steps:

1. Decide if the symbol should be + or -.
2. Write the phrase.
3. Solve it.

Class B: The teacher reported that this went well, although many of the problems were done as a group instead of individually. The children were encouraged to use tally marks to solve.

Activity B. In this activity the children are introduced to writing and solving part-part-whole sentences.

Class A: The teacher began by having eight children stand. She asked how many children were standing. The rest of the children counted by one's, two's, or three's.

The teacher suggested looking at groups.

Teacher: "How many boys?"

Children: "Four."

Teacher: "So there are four and we could count on the girls five, six, seven, eight."

Children" "You could just figure it out in your head."

Next the teacher asked what sentences could be written.

Children wrote the following sentences on the board.

$4 + 4 = \boxed{8}$

$3 + 5 = \boxed{8}$

Then one child wrote $10 - 2 = \boxed{8}$

Teacher: "That's a true sentence, and a very good one, but does it go with our set? Did we start with 10 children?"

Children. "No." (Changed sentence to $5 + 3 = \boxed{8}$.)

Other children commented, "It's just the same with the numbers changed around," when they compared $5 + 3 = \boxed{8}$ and $3 + 5 - \boxed{8}$.

Teacher: "Are there any other sentences?"

Child wrote: $6 + 2 = \boxed{8}$

Teacher: "They all seem to be add on."

Child wrote $8 - 0 = \boxed{8}$.

During the next two days the teacher introduced the part-part-whole terminology. The children seemed to understand, but had difficulty with the pages. The teacher thought further instruction was necessary.

Accordingly, the next day, May 10, the teacher reviewed part-part-whole and did several examples.

$$\text{Part} + \text{Part} = \overset{\text{Whole}}{\square}$$

$$\text{Whole} - \text{Part} = \overset{\text{Part}}{\square}$$

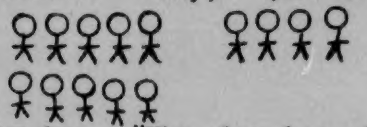
Sometimes the desire to solve immediately and the ease of doing so by counting objects totally eclipsed any concern the children might have for writing the sentence. For example, the teacher did the following problem.

"14 parents were at the PTA meeting. 5 were mothers. How many were fathers?"

Teacher: "What do we know?"

Children: "14 parents."

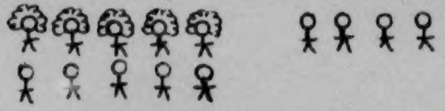
Teacher: "Okay," (She drew 14 stick figures.)



Teacher: "Wht else do we know?"

Children: "5 are mothers."

Teacher: "Okay." (Put hair on 5.)



Teacher: "5 mothers. That's part of the parents. What part do have to find?"

Children: "The fathers."

Teacher: "Who can come up and write a story?"

One child came up and wrote 5, then seemed stumped. Another came up and wrote 5 9, saying, "I counted 5 and then I counted 9."

Teacher: "Oh, you solved. What about writing the sentence?"

Child wrote $17 - 5 = \square$

Teacher: "Is that right? Where did the 17 come from?"

Child: "Oh, 14." (Wrote $14 - 5 = \boxed{9}$.)

They validated by counting.

Class B: No report.

Comments

The Part + Part = $\boxed{\text{Whole}}$ is not difficult for the children. Most have little problem writing the sentences. However, Whole - Part = $\boxed{\text{Part}}$ creates many problems. The children have trouble identifying the whole and parts.

Activity C. In this activity the children measure length or weight and then write and solve part-part-whole sentences. This is somewhat harder than Activity S-2 B.

Class A: The teacher introduced the length or card part of the activity and had the children do the stations. This took several days because the preparation time was long, the explanation and examples in the teacher's guide were not sufficient to enable the children to understand the concept, and even after the children seemed to understand the concent, they needed guidance on almost every station.

The teacher thought she should start over. Although, it was pointed out that mastery was not expected, the teacher thought the concept and problem solving practice (thinking) was important enough to warrant spending more time. It was decided the initial discussion and examples should be more physical.

The teacher then reintroduced the problems by making a long chain of links which she wrapped around things (including children), presenting two situations: Part + Part = Whole; Whole - Part = Part. They did not solve, but discussed solving methods.

The children then redid the cards. At the end of this the teacher pointed out that it had taken 6 days for the children to begin verbalizing (talking about parts and wholes voluntarily). She believed the cards did not reflect how well the children understood the basic concept. All the children understood that the problems involved three related bits of information. Most understood Part + Part = Whole, and many understood Whole - Part = Part.

It was concluded that the cards are challenging, but should come after more practice with the part-part-whole model.

The weighing part of Activity C required substantial initial teacher direction, but went well. Most children wrote correct sentences and solved accurately.

Class B: This activity took several days. The teacher explained the length cards and stations and demonstrated how to solve. When she asked the children to do more examples, they didn't understand. After the teacher explained again, some children understood Part + Part = Whole, but not Whole - Part = Part. The teacher separated the class into two groups so that she and the student teacher could go through half of the cards with the children in a small group situation. The children then did the cards individually. Few children did well without further explanation and help from the teacher.

Only five of the children in the class did the weighing. They didn't understand what was happening or why. Some still thought the situation was adding rather than subtracting. One boy, whose container weighed 20 washers and was labeled "extra 7," didn't understand that, to find the mystery weight, he had to write 20 - 7. Instead he wrote 7 - 20 and concluded the problem couldn't be done.

No children finished the activity.

Activity D. This activity introduces difference situations. The children write sentences to represent these istuations and solve the sentences.

Class A: The teacher reported that this activity went well. She wondered if it would be better to organize the topic so that difference situations were done before part-part-whole.

Class B: No report.

Activity E. In this activity the children write and solve difference sentences that describe situations using the attributes of height, weight, and length.

Class A: The teacher reported that this activity went well. Page 11 took more direction than some other pages in the topic.

Class B. Did not do.

Activity F. In this activity the children are given open addition and subtraction sentences to solve. Emphasis is on the numbers 0-6.

Class A: The teacher reported that this activity went well and provided good practice.

Class B: Did not do.

Activity G. In this actiivity the children are given further practice in solving open sentences. They also look at various number properties.

Class A: The first part of the activity went well. The teacher thought the concept of sentence families was important and wanted all the children to understand it.

After completing page 19, the teacher brought the children together in a large group to discuss sentence families. Each child had 10 cubes to use in representing sentences.

The teacher instructed the children to think about why the numbers in each house on page 19 are a family.

Girl$_1$: (Carefully read all the sentences in A.) "They're the same, just changed around."

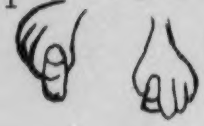
Girl$_2$: "They all add up to equal 5."

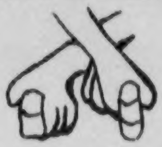
Teacher: "Okay, now think about the whole and the parts. Look at the families. Can you show me with the cubes what's happening?"

Boy$_1$: (points to $3 + 2 = \boxed{5}$.) "You have 3 of these kind (takes 3 red cubes) and 2 blues. You put one part with the other part. You count and get 5."

Teacher: "Good ideas. You're saying if you take the two parts, they add to the whole. Can you show me $2 + 3 = \boxed{5}$?"

Boy$_1$: "You just switch them around."





Teacher: "What else could you show me about this family?"

Girl$_3$: "You can do 5 - 2." (Shows 5 cubes, takes away 2.)

Teacher: "Oh! Hey! The 5 is our whole for this family. The whole, take away one of the parts, equals the other part."

Girl$_3$: "There's another one here: 5 - 3."

Teacher: "Good. The thing to remember is that the whole and the parts stay the same. What about the family for 4 + 1?"

The teacher had the children identify the whole, 5, and the parts, 1 and 4. She pointed out that although the whole was the same as before, the parts are different. Therefore this family is a different one.

Teacher: "Who can write the sentences for this family?"

Child$_1$: "There's 1 + 4." (Wrote $1 + 4 = \boxed{5}$.)

Child$_2$: "That's 4 + 1 turned around. There's $4 + 1 = \boxed{5}$."

Teacher: "Anything else?"

Child$_3$: $4 - 1 = \boxed{3}$.

Teacher: "I don't think so. It isn't the same whole. Where's the 5? You have the 4 and the 1, but those are parts. Can we ever start a take away with a part?"

Child$_3$: "No." (Wrote $6 - 1 = 5$.)

Teacher: "Touch the number that's a whole."

Child$_3$: (Looked puzzled.) (Oh." (Erased $6 - 1 = 5$ and wrote $5 + 1 = \boxed{}$, then erased that. Finally wrote $5 - 4 = \boxed{1}$.)

Teacher: "Wonderful! I can see you were thinking about the parts and the whole while you wrote the numbers."

The teacher wrote $3 + 4 = \boxed{}$ on the board.

Teacher: "Who can solve it?"

Child$_4$: $3 + 4 = \boxed{7}$.

Teacher: "What other sentences are in this family?"

Child$_5$: $4 + 3 = \boxed{7}$.

Child$_6$: $4 - 3 = \boxed{1}$.

Teacher: "Is it the same whole?"

Child$_6$: "No." (erased)

Teacher: "When we take away, what do we always start with?"

Child$_6$: "The biggest number."

Teacher: "What is that?"

Child$_6$: "Five."

Teacher: "Is it always 5?"

Child$_6$: "No--it's the whole."

Teacher: "What's the whole for this family?"

Child$_6$: "Seven."

Child$_7$: "You could do $7 - 4 = 3$."

Child$_8$: "And $7 - 3 = 4$."

The teacher did several more examples and continued work on sentence families for two more days. She reported that most children could write four sentences correctly.

Class B: Did not do.

Activity H. This activity reviews validating.

Class A: The teacher reported that this went well.

Class B: Did not do.

General Comment

The Class B teacher reported that her class did so poorly on S-2 that they should start over with it next fall. She attributed their poor performance to immaturity and poor classroom behavior, as well as to the topic's lack of sufficient introduction and practice with the part-part-whole concept before difficult problem situations are presented.

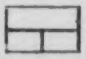
Report on Topic S-3, Solving Number Sentences 0-10

This section follows the same format adapted in the previous section. This topic was taught early in the fall semester of 1978-79. The two teachers were different from those involved in the tryout of Topics S-1 and S-2. As in the previous school year Class A included the better students and Class B, the weaker students. Because of poor performance the previous year, Class B repeated Topic S-2 before doing S-3.

Overall Description of Topic

Topic S-3. Here the vertical notation $\begin{array}{r} a \\ \underline{+b} \end{array}$ and $\begin{array}{r} a \\ \underline{-b} \end{array}$ is introduced along with the vocabulary words "addition" and "subtraction." Problem situations include all those covered previously. The intent is to demonstrate that thinking of all problems within the context of part-part-whole will help the student decide whether to add or subtract. The last part of the topic deals with practicing basic facts involving numbers 0-10.

Activity A. The children are introduced to the terms addition and subtraction, and to the general, symbolic part-part-whole model for analyzing subtraction and addition situations.

Class A: The activity went well, but required some review of the whole and parts. The teacher thought the children should record the answer to a problem only in the "mystery" box in the sentence ($a + b = \boxed{}$) and not in the part-part-whole chart (). Once the children had filled the answers in on the chart, they couldn't use it to check whether or not they used the right sign (+ to find a missing whole; - to find a missing part).

On student booklet pages 2 and 3, the wording of the problems was confusing for some children. For example, "There are 13 books. Five are about ghosts. Some are about water. How many are about water?" The story should read, "There are 13 books. Five are about ghosts. The rest are about water. How many are about water?"

Class B: The teacher thought the children needed more practice using the part-part-whole chart, primarily in relating the numbers in a story to the positions on the chart. She had the children circle the numbers in each story before deciding where each number should go on the chart. She emphasized that only those numbers actually given in the story should go on the chart before writing the sentence.

The teacher also thought the children could not read well enough to do the student booklet pages on their own. These pages were done as a group, which worked well.

Activity B. In this activity the children are given a variety of addition and subtraction situations for which they write and solve sentences. Situations in which the word order is unfamiliar to the children are also introduced.

Class A: This activity took more time than the teacher expected, but once the children understood that the charts could not be filled in, the activity went well.

Class B: The teacher thought the reading level was too difficult, so the class did the student booklet pages together. The teacher had to continually remind the children to use the numbers at the top of page 8, instead of the previous answers.

Activity C. Vertical notation for addition and subtraction sentences is introduced in this activity.

Class A: There were no comments.

Class B: The children had some difficulty understanding what was meant by "validating" and which number in the problem on the board they were to correct. Finally the teacher had the children pretend they were the aide and were to correct the pages. Somehow this seemed to make it easier for them to understand they were correcting the number below the line. This may indicate that more background material should be added on which parts of vertical notation correspond to the parts of a sentence in horizontal form and in the given situation.

Activity D (Optional). This activity provides practice in finding sums and differences using vertical notation.

Class A: Weighing the rocks for student booklet page 15 was no problem, but the children didn't know what to do with the weights once they got them. The children were confused about which rocks to compare to complete the chart on page 15. The teacher suggested that each child have one rock instead of two and that each pair of children find only one sum and one difference.

Class B: For the rock weighing activity, the children used only one rock apiece, as suggested by Teacher A. The activity went well.

Activity E. This activity provides practice in addition and subtraction.

Class A: Both the teacher and the children liked the practice except for the page on money.

Class B: There were no comments.

Activity F. In this activity the children practice the addition and subtraction facts for 0-10. They also explore number relationships and patterns.

Class A: The families of sentences were difficult. The children still wanted to do families or names of numbers. For example, many children said $6 + 1 = 7$ for $5 + 2 = 7$, rather than $2 + 5 = 7$, $7 - 2 = 5$, or $7 - 2 = 2$.

Class B: Same comments as for Class A.

Results of the Topic Inventory

Topic S-3 marked a mastery point in the progression toward computation skills with topic addition and subtraction facts. By the end of the topic it was expected that the children should perform well relative to the following two objectives:

1. Given an open sentence of the form $a + b = \square$ or $\begin{array}{r} a \\ \underline{+b} \end{array}$ involving the numbers 0-10, solves it.

2. Given an open sentence of the form $a - b = \square$ or $\begin{array}{r} a \\ \underline{-b} \end{array}$ involving the numbers 0-10, solves it.

Ten items were used to assess each objective. Half of the open sentences were in the horizontal form and half in the vertical. The teacher reported the following results, apparently lumping the two objectives together.

Class A: All 23 students achieved mastery.

Class B: A total of 13 achieved master, 5 had progressed toward mastery, and 1 needed more help.

Report on Topic S-4, Solving Situations 0-20

The data presented for Topic S-4 are in the same format as Topic S-3. The two classes proceeded independently with Class A receiving instruction in the topic 2 to 4 weeks earlier in the school year.

Overall Description of Topic

Topic S-4. Up to this time, the problem situations have been straightforward in that the most obvious sentence to write as a representation is the canonical one $a \pm b =$ (or the vertical counterpart). In this topic, more analysis on the child's part is required to determine whether to add or subtract in problem situations that are not so straightforward. The equalizing situation is presented together with "missing addend" types. Again, the latter portion of the topic is devoted to practicing basic facts, this time involving numbers 0-14.

Activity A. In this activity the children are given joining and separating situations. For the first time, they do not write sentences. They solve using the part-part-whole analysis and chart, and write the problem in vertical form.

Class A: Went well. No comments.

Class B: On page 3, the children had difficulty "reading" the picture as part of the problem. After the teacher demonstrated how to read the problems the page went well. The teacher suggested the following form for such problems:

There are 10

7 go away.

How many are left?

Activity B. This activity uses weight and length situations to reinforce part-part-whole analysis.

Class A: The children had difficulty with the entire activity. The teacher thought they hadn't worked enough with part-part-whole to use it with missing addend. She thought there should be greater emphasis on identifying whether the whole or a part is missing.

The format of page 4 was too difficult. The teacher thought the time spent explaining how to do page 6 wasn't worth what it offered in content.

Class B: The teacher thought the material came "too soon" and "too suddenly." She wanted to observe how well the children understood part + part = whole and whole - part = part, before using these concepts for analyzing more difficult situations.

The teacher suggested eliminating the "candle page" (page 4) because, although it was cute, the words "shrank" and "shrunk" were too difficult, as was the format. She also thought page 6 should be skipped.

Activity C. In this activity the children are given situations that may be represented by the open sentences $a \pm \square = c$, $a + b = \square$, and $\square \pm b = c$. The children are not asked to write sentences. They use the part-part-whole chart to analyze and solve.

Class A: The teacher and the children enjoyed the "worm pages" (student booklet pages 7 and 8). She thought that Activity C should come before Activity B.

Class B: The response was the same as for Class A. In addition, the teacher thought there should be a group discussion that would bring "closure" or "reinforce" what the children had been doing with "the worms." The teacher also thought the wording on student booklet pages 9, 10, and 11 could be simplified. The children found page 11 particularly confusing. The teacher suggested moving the story problems to a later activity.

Activity D. In this activity the children are given open sentences of the form $a \pm \square = c$, $\square \pm b = c$, and $a \pm b = \square$ They are asked to solve, at first with no specific directions, and then by using the part-part-whole chart.

Class A: The teacher thought the activity went well and treated it like a mystery puzzle, which the children seemed to enjoy.

Class B: The teacher questioned the value of part of the activity. She thought it should be optional and used only with children who had done well on previous activities. She thought using the chart in part 2 was helpful, but that labeling the whole and the parts in the sentence, and then filling in the chart before solving needed more emphasis in the Teacher's Guide.

Activity E. In this activity the children practice solving open sentences.

Class A: The teacher had no comments.

Class B: When the children had to validate sentences, they considered the number after the equal sign to be the "answer" rather than the number in the box. Even after much teacher direction some children still insisted upon this. The teacher decided that doing the pages was still valuable anyway, since the children were recognizing false sentences and changing them to true ones.

Activity F. This activity provides games and puzzles to practice addition and subtraction (0-20, particularly with facts having the sums 9-14).

Class A: The preparations for the grid game need to be simplified. The teacher suggested that the children could fill in their own grids.

Class B: Same comment as Class A.

Activity G. The children practice addition and subtraction facts 0-20, especially those with sums 0-14. They also explore number patterns and relationships introduced in Topics S-2 and S-3.

Class A: The teacher thought the pages provided good practice. She thought some of the number patterns and relationships were valuable to her as well as the children.

Class B: The teacher thought the pages were good, although she wasn't certain the children saw, understood, or used any of the number relationships shown.

In explaining the sentence families, she suggested that an analogy between the triplet of numbers in a sentence and the number of children in a family be used. This would help the children use the same three numbers. For example:

Smith

Sentence $$\underset{\substack{\uparrow\\ \text{number of}\\ \text{girls}}}{2} + \underset{\substack{\uparrow\\ \text{number of}\\ \text{boys}}}{3} = 5 \longleftarrow \substack{\text{number of}\\ \text{children}}$$

Report on Topic S-5, Solving Situations and Sentences 0-20

Overall Description of Topic

Topic S-5. More practice in writing sentences or their vertical counterparts to represent a variety of problem situations is given. Various techniques for remembering basic facts are formally presented. Practice with facts 0-18 is given.

Activity A. This activity reviews situations from previous sentence writing topics. However, in this activity the children are asked to fill in the part-part-whole chart, write a sentence, and record in the vertical form before solving.

Class A: The activity went well. The children liked the collecting theme. Student booklet page 6 required more teacher direction than was indicated in the teacher's guide.

Class B: The children liked the pages. The teacher suggested each page should have at least one worked example to help the children understand the type of response required on that page.

Activity B. For the first time, the children write and solve difference sentences using the part-part-whole chart. This provides the background for why "difference" implies a subtraction sentence.

Class A: The teacher thought the part-part-whole analysis of difference was explained well, but she doubted that the children understood it completely. She had to point out several times that the following three questions require a subtraction sentence:
How many more? How many less? What's the difference?

Class B: The children needed a lot of teacher direction. The teacher wasn't sure that having the children change from circling the larger number on student booklet page 8 to circling the smaller number on page 9 was necessary at this point. She thought this was necessary, though, for a thorough understanding of difference situations. She believed the part-part-whole chart helped.

Activity C. This activity uses weight situations to give the children practice writing and solving sentences. Most situations given are difference situations.

Class A: The teacher had the children do the two types of weight stations in part 1 on different days rather than doing both the same day. She thought this was easier to manage and gave the children more practice.

Class B: The set up for the weight station was too difficult and needed more explanation in the teacher's guide. Once set up, though, it worked. It was difficult for the children to turn back to the chart on page 11 to answer the questions on page 12. The teacher thought this should be set up better.

Activity D. In this activity the children practice writing and solving difference sentences from length situations.

Class A: The children enjoyed this activity, particularly the "Great Guess-and-Measure Machine" game on page 16. The teacher especially liked the fact that each child had a copy of the game. She suggested using strips of construction paper rather than adding machine tape, as they are more manageable

Class B The "Great Guess-and-Measure Machine" activity and game went well. Student booklet page 17 was somewhat difficult for the children. The phrasing of the questions on student booklet page 18 confused the children, and the layout was cramped and distracting. The teacher thought it was good practice to have the children measure, but it should be done in an easier context.

Activity E. This activity introduces the separating situation represented by $\square - b = c$, or the part-part-whole sentence, whole - part = part, where the whole is unknown. The situations introduced in previous sentence writing topics are reviewed also.

Class A: Went well. The teacher thought the children understood the activity.

Class B: No comments.

Activities F and G. Activity F helps children organize their thinking so that solving open sentences is easier. It deals with grouping the numbers to be added or subtracted by 10's.

Activity G helps children organize their thinking so that solving open sentences is easier. It deals with sums and differences involving the number nine and suggests a way to use the doubles facts to help solve problems.

Class A: The teacher thought the "9 and 10 short-cuts" were confusing instead of helpful, except to a few children who had a clear understanding of the numbers 11-20, and who had retained mastery of the fact 0-10. She thought this activity should be labeled challenging and optional.

Class B: These activities created confusion, and, in the teacher's estimation, did not help the children at all. She suggested replacing them with more on the facts 0-20 or with games that could be used.

Activity H. This activity provides a variety of games and activities to practice writing and solving sentences.

Class A: The directions on how to play "Beat Wanda Winner" need to be clarified, especially the scoring. The teacher thought the children enjoyed the game.

"Solid Collections" was too easy. The same number combinations appeared too frequently to make the game interesting.

Student booklet page 33 was good, but the teacher had to caution the children several times to be careful following directions.

The teacher used the other games for a special math game day.

Class B: The teacher thought "Beat Wanda Winner" and the "Mystery Container Game" were the best parts of the activity. She didn't have time to do all of the activity.

Report on Topic S-6, Mastering Writing and Solving Sentences 0-20

Overall Description of Topic

Topic S-6. In this last topic the emphasis has clearly changed from writing sentences to solving sentences. The addition of three addends is presented, as well as the more abstract notion of "name for a number." Mastery of all the basic fact combinations with the numbers 0-20 will be expected by the end of this topic, with complete memorization strongly encouraged. Much of this topic was taken directly from DMP topics 32 and 35.

General Comments

Class A: The teacher thought the children had learned the part-part-whole analysis and that it helped them become better at solving verbal situations. She thought that, although Topic S-6 provided good practice, it was too long.

Class B: The teacher thought the part-part-whole analysis was useful for most children in all of the problem situations presented, except difference. She believed that having the children think about "comparing" would be more helpful in analyzing difference problems. She also thought Topic S-6 was a little long.

Neither teacher "saved" activities E through H for use as a periodic review.

Activity A. This activity reviews writing and solving sentences 0-20.

Class A: The children liked "Space Patrol," however, the language in both the story and the problems could be simplified.

Class B: No comments.

Activity B. This activity gives the children practice in writing and solving sentences.

Class A: In Part 3, graphing results was the best part of the activity. In Part 2, the teacher did not believe all children should do all pages, so she had different groups doing different pages.

Class B: In Part 2, pages 10-13 were too difficult to require all the children to complete them. Questions such as, "What is the difference between $U + X$ and $W + V$?" were too hard. The teacher suggested deleting these or labeling them optional and challenging.

Activity C. In this activity the children make up story situations that interpret given number sentences. In addition they validate solutions of sentences.

Class A: The teacher and the children both enjoyed making up story situations to describe open sentences; however, sentences of the type $16 = \boxed{} + 13$, with the lone term to the right of the equal sign were too difficult. They should not be included for all children since they have not seen this form of sentence. However, the teacher suggested making them optional and challenging.

Class B: The teacher had no comments.

Activity D. More than two numbers are added to or subtracted from another in this activity. Sometimes sentences are written, but usually the emphasis is on the solution rather than the sentences.

Class A: The children liked the "Add'em Up" characters. Doing two-step problems in which the sum of three numbers is subtracted from a fourth number was difficult, but the teacher thought it was worthwhile.

Class B: In Part 3, the game "Sum Fun" went well. In Part 4, the game with numbered chips was good, but the preparation was time consuming. The teacher suggested that colored cards of premarked chips be included in the printed materials, instead of having to mark the chips with numbers. Then, the only preparation would be to cut out chips.

Activity E. In this activity open sentences 0-10 are solved and validated. Number families are introduced.

Class A: The activity went well. The teacher thought "number families" were an important concept and liked how they were presented.

Class B: The activity went well. The teacher had no comments.

Activity F. This activity generates names for numbers.

Classes A and B: The teachers had no comments.

Activity G. This activity used student booklet pages and games to give children practice in solving open sentences and in writing sentences to describe problem situations.

Class A: The teacher skipped most of the games, and had the children do only the student booklet pages. The children liked the coloring page (p. 28) and "step" pages 29-31. The "magic square" pages were difficult at first, but once the children understood where to begin, they had little trouble and enjoyed the pages.

Class B: The children liked the "step" pages best and had the most trouble with the "magic squares" on pages 29-31.

Activity H. This optional activity contains challenging problems for those children ready to seek out patterns and to form generalizations.

Classes A and B: The teachers had no comments.

Topic Inventory

Class A: All children scored at mastery on number facts and at mastery or progressing on sentence writing. The most frequently missed problem was:

Some jacks were in a bag.
Alan took out 4 jacks.
There are 10 jacks left in the bag.
How many jacks were in the bag to start with?

Three-fourths of the children wrote $10 - 4 = \boxed{6}$ as the sentence for that situation.

Class B: The Topic Inventory results were not reported.

REFERENCES

Moser, J. M. Young children's representation of addition and subtraction problems. Center Theoretical Paper No. 74. Madison, WI: Wisconsin Research and Development Center for Individualized Schooling, 1979.

Romberg, T. A., Harvey, J. G., Moser, J. M., Montgomery, M. Developing Mathematical Processes (DMP) Madison, WI: Wisconsin Research and Development Center for Cognitive Learning, 1974, 1975, 1976.

APPENDIX A

TOPIC S-1: INITIAL SENTENCE WRITING

TOPIC S1 INITIAL SENTENCE WRITING

OBJECTIVES

Preparatory

1. Given an open problem situation involving the numbers 0-20 that is solvable by using either addition or subtraction, writes a sentence that represents the situation. (writes open + or - sentence 0-20)
2. Given an open sentence of the form $a + b = \square$ or $\begin{array}{r} a \\ +\,b \\ \hline \end{array}$ involving the numbers 0-10, solves it. (solves $a + b = \square$ sentence 0-10)
3. Given an open sentence of the form $a - b = \square$ or $\begin{array}{r} a \\ -\,b \\ \hline \end{array}$ involving the numbers 0-10, solves it. (solves $a - b = \square$ sentence 0-10)

OVERVIEW

Whether or not we have always explicitly mentioned it and whether or not you have explicitly realized it, you and the children have been dealing with addition and subtraction problem situations for some time now. In fact, the children have probably devised some strategies for solving those problems. Some of these strategies have resulted from their work with DMP but it is also quite likely that some of the strategies have been worked out independently of formal instruction.

The major feature of this topic is that it is the first time in the DMP program that the traditional symbolism associated with the addition and subtraction operations will be used. As such it is the first of many DMP topics that all have as their major goal the development of efficient problem solving behaviors in children with respect to addition/subtraction problem situations. Consider an example:

> Todd has 2 dollars and Maria has 3 dollars. How many dollars do they have altogether?

At their current stage of development, many, if not most, of your children could probably correctly respond "5 dollars." If asked how they got the answer, you might hear, "I just know it" or "I counted 3, four, five." However, if the amounts were changed to 8 dollars and 9 dollars, the number of correct responses as well as the strategies used would be different. You would get fewer "I just know it" responses and more counting and probably some physical or pictorial modeling along with counting. As the children get older, and if the amounts were changed to 38 dollars and 49 dollars, then the hoped-for strategy would most likely be $\begin{array}{r} 38 \\ +\ 49 \\ \hline \end{array}$ written by the child and then correctly computed. That definitely would be the desired behavior if the amounts were 2,328 dollars and 4,049 dollars! Many DMP topics and a great deal of work by you and succeeding teachers lie between your children's present problem solving capabilities and the ultimate efficient problem solving behaviors.

In order to reasonably delimit the discussion, we will consider only one-step problem situations dealing with addition and subtraction. Some of the discussion will also be applicable to multi-step problems as well as to multiplication/division problems. The DMP approach to problem solving involves several steps on the child's part:

1. Analysis of the problem. Within the present context, this implies looking at the two numbers involved and deciding whether addition or subtraction is the appropriate operation.

2. Representation in a symbolic way. This will usually mean an open sentence. At first, the sentence will be horizontal, e.g., $8 + 4 = \square$ but later the vertical form, e.g., $\begin{array}{r} 18 \\ +\ 27 \\ \hline \end{array}$, will be encouraged.
3. Solution of the open sentence. At the present stage, a number of different strategies can be expected from the child. Much of the instructional effort in succeeding DMP topics will be devoted to teaching the child the more efficient methods of computation that involve memorization of "basic facts" and understanding and use of traditional computational algorithms.
4. Validation or verification of solution. This implies not only the simple checking of the correctness of computation but also the reasonableness of answer to the original problem situation. Included within this category is the whole notion of estimating the size of the solution prior to engaging in computation.

It must be emphasized that neither sentence writing nor acquisition of basic facts nor computational accuracy are ends in themselves. They are simply component parts of the overall greater aim of problem solving ability.

In this first sentence writing topic, only the problem situations of simple joining and separating are considered. By simple is meant the context that results in sentences of the form $a + b = \square$ or $a - b = \square$. No missing addend ($a + \square = c$), missing subtrahend ($a - \square = c$) or missing minuend ($\square - b = c$) contexts are presented. After the children review joining and separating, they are introduced first to the + (add on) and - (take away) symbols. The joining and separating situations are structured so that the initial emphasis is on the operation rather than the solution. When the children have become familiar with the symbol, they then write phrases (7 + 1, 7 - 1) to represent joining or separating situations. The emphasis shifts to that of representing and solving.

After writing phrases for the add on or take away situations, the children are introduced to writing and solving the complete sentence. As indicated earlier, you can expect a variety of solving behaviors at this time. In fact, in many cases the children will probably solve the situation before they write a sentence and may balk at writing something they view as unnecessary. Handle such behavior as best you can. Here are some of the strategies children may use.

1. Knowledge of some basic number combinations. This is the "I just know" response. This may be due to practice imposed by a parent or previous teacher. Usually a child will not know all facts, just some simple addition combinations and some of the "doubles" facts like 4 + 4 = 8.
2. Counting. When presented with a physical stimulus (blocks, cubes, arbitrary measurement units) or with pictures of things, a child may simply count out the sets. Sometimes he/she will count the totality of the joined sets in

addition (i.e., start counting, 1, 2, 3, _, _, _) but at other times it is a counting up from the number of one of the sets. For example, when asked to find the sum of 7 cubes and 4 cubes, the child may count "7, eight, nine, ten, eleven" where the written number words are kept track of. This is, perhaps the most efficient counting straregy, but other children may count up seven numbers from the 4. When the problem is of a missing addend type, such as "I have 7 pennies and a toy costs 12¢. How many more pennies do I need?" Some children will add up from 7 to 12 while others will count down from 12 to 7.

3. Modeling. The child will represent numbers given in a problem by using counters (cubes, links, buttons) or by drawing pictures. When pictures are given in a problem situation, the child will most likely use those pictures themselves as models and may cross out some pictured objects if it is a subtractive situation or draw some more pictures in if it is an additive situation. After modeling, the child will most likely count the resulting set beginning with 1 in order to determine the final solution.

Each of these strategies has its value, and for a child who can use one of them efficiently and well, it would have a great deal of value. As a teacher, you will have to assess each individual child and build upon his/her strengths. A great deal of verbalization and discussion of the various ways to solve may give certain children insights into these alternative strategies. Valuable things to consider are the fact that the result of adding is always a number that is larger than either set that was joined to make that sum (except, of course, when one of the numbers is zero), and similarly that the result in subtraction is smaller than the set you take from, and that it is impossible to subtract a larger number from a smaller number.

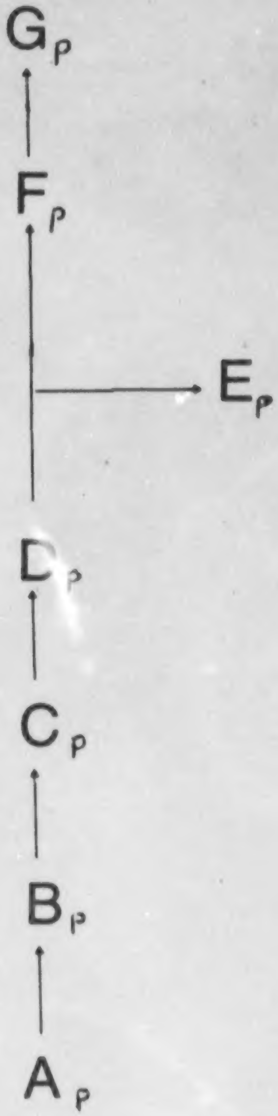
Prior to this topic the children's experience with equality has been such that they could see the two equal sets or the two parts of one set that equal the other. This is not always the case with the joining and separating situations presented here. If there are children who are having difficulty with this, different colored sets could be used to represent the situation.

For example: A rabbit has 5 spots. The machine gives him 4 more. How many does the rabbit have?

Five yellow links could be used to represent the number the rabbit had, four blue ones could represent the number added on. These two sets could be joined and matched to a set of nine that you had constructed previously (perhaps as part of a group of 0-10 sets).

No mastery of objectives is expected in this topic. You should not begin any formal "drill" with basic facts at this time. A gradual introduction to memorization will be presented in the next sentence writing--addition/subtraction topic.

SUGGESTED SEQUENCE CHART


G_p
F_p
E_p
D_p
C_p
B_p
A_p

ACTIVITY S1 A

In preparation for the introduction to the + and - signs and for writing mathematical sentences, this activity reviews joining and separating with the children verbalizing what they are doing.

Objectives

1 writes open + or - sentence 0-20

2 solves $a + b = \square$ sentence 0-10

3 solves $a - b = \square$ sentence 0-10

Organization

large group (Parts 1, 2, 3)

individual (Part 3)

Vocabulary

add on

take away

Materials

Student Booklet page 2 (Part 1)

Student Booklet pages 3 to 5 (Part 3)

Cards S1A a-h (Part 2)

links (Parts 1, 2, 3)

cubes (Part 3)

Preparation

Part 1. Make chains of 7, 8, 9, or 10 links. Make enough so that each child has one. Fill a large container with links.

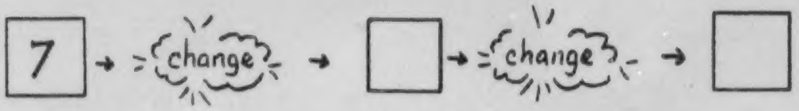
Part 2. Cut apart Cards S1A a-h.

Teaching Suggestions

Part 1 In this part the children make and record joining and separating changes made to chains.

Give each child a chain that is 7, 8, 9, or 10 links long and Student Booklet page 2.

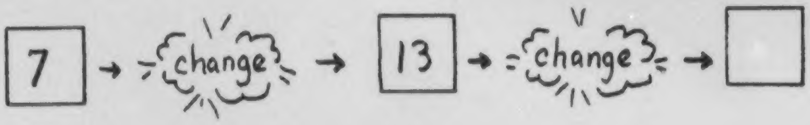
Have the children record the number of links in their chain in the first box on page 2.



Take a handful (0-10) of links from a large container. Have the children count with you the number of links you drew. For example, 6.

Than say, "First change. ADD on 6 links. Each child adds 6 links to his or her chain.

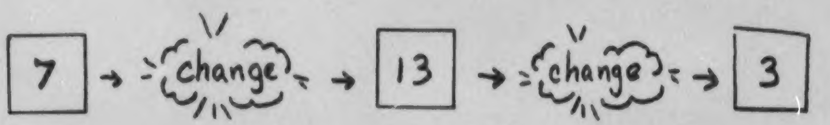
Then ask, "How long is your chain now? Have them record in the middle box.



Draw another handful of links and count them with the children. (For example, 10 links)

Announce, "Second change, TAKE AWAY 10 links. Each child takes 10 links from his or her chain.

Ask, "How long is your chain now?" Have them record on the last box.



Now have one or more children show their paper and explain what happened. For example: "I had 7 links. I added (or put on) 6 links and got 13. Then I took away 10 links and had 3 left." or "When I put more on, my chain became 13. When I took some off, my chain became 3."

Play 6 more rounds of Chain Change. The children can keep the same beginning number, or they can exchange chains.

Variations:

1. Begin with 17, 18, 19, or 20 links. First, subtract, then add.
2. Begin with 17, 18, 19 or 20 links and 2 subtraction changes.
3. Begin with 1, 2, or 3 links and make two addition changes.
4. Begin with 10-20 links and make subtraction changes until you "dead end"--or have to take away more links than are in the chain.

Part 2 In this part, as a group, the children guess the directions on a card. This is for practice with physical objects. If the skill at guessing or describing the directions seems beyond the children's ability, go on to the next part.

Begin by drawing one of the Cards a-h. For example: Card a

Make a chain of 9 🔗.
Make a chain of 4 🔗.
Put them together.
How many 🔗 altogether?

Do what the card says, counting links aloud, so that the children can see how many you used.

Write the answer, 13, on the board. Ask what the card told you to do.

Do one more card. Then choose children one at a time to do the remaining cards. Have each count as you did and write the answers on the board.

Part 3 This part provides three student booklet pages. At this point in time, let the children use whatever strategy they want to help solve.

Student Booklet page 3. Do this with the children as a group. Discuss various strategies.

Student Booklet pages 4 and 5. The children should try these on their own.

ACTIVITY S1 B

In this activity the children are introduced to the + and - symbols. They choose or write the symbol that describes the joining or separating situation given.

Objectives

1 writes open + or - sentence 0-20

2 solves a + b = ☐ sentence 0-10

3 solves a - b = ☐ sentence 0-10

Organization

large group (Part 1)

individual (Part 2)

Vocabulary

+ (addition or add on)

- (subtraction or take away)

add

subtract

Materials

Picture Cards 23H a-c and S1B a, b

Student Booklet pages 6 to 9 (Part 2)

Preparation

No special preparation.

Teaching Suggestions

Part 1 Read the Story "The Unput-Putter (Teacher Guide pages 16 to 18) and show the Picture Cards as indicated in the story.

When you have finished, put the + and - symbols on the board. Discuss with the children what the symbols could be called. Have the children read the symbol + as "add" or as "add on" and the symbol - as "subtract" or "take away."

Then read the following stories to the children and have them decide where the dial on the Upper-Putter was set, at + or -. (Encourage verbalization by kids as to why they choose + or -, i.e., because there is more often a change, or less often the change.)

1. Mrs. Dribble brought her yellow anteater, Alvin. He went in with no spots and came out with five beautiful orange ones. Where was the dial? (+)

2. Then there was little Horace Bedsteader and his pet turtle, Dennis. Dennis crawled in with three spots on his back and came out with nine. Where was the dial? (+)

3. Poor Bianca Gillydiddle came to Mr. D. Zine with a problem. Her pet praying mantis, Lucifer, had too many stripes. So Lucifer, who had seven stripes, went through the Unput-Putter and came out with only four. Where was the dial? (-)

4. Farmer Fitzfeather's favorite cow, Frosty, wandered too near the machine. She used to have eight spots, but when she emerged from the machine, slightly shaken, she didn't have a single one! Where was the dial? (-)

5. A nearsighted gnu named Gus walked into the machine by mistake. When he went in, he had three stars on his tummy. When he came out, he had ten stars. Where was the dial? (+)

6. Hugo, the duckbill platypus, went into the Unput-Putter with three spots. He came out with four spots on his back and two on his bill. He admired himself in the shiny side of the machine. Where was the dial? (+)

Part 2 Student Booklet pages 6 and 7. Have the children do these individually after some direction. Do some examples first. The children are to circle either the + or the - to show what happened. If the children have problems, tell them to compare the number of spots in the "before" and after." If the "before" is greater than the after, some things were taken away. If the "before" is less than the "after," some things were added on. Discuss these two pages before going on to pages 8 and 9.

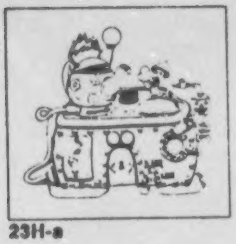
Student Booklet pages 8 and 9. Tell the children that Mr. D. Zine decided that if the machine could put and unput designs on animals, it could do the same things to objects like tools, toys or teapots. Discuss the example on page 8. The children are to write + or -

on the circle (or dial) to show what happened. Do some other problems from page 8, explaining that the machine isn't pictured, just the objects. First comes the picture of how the object looked before it entered the machine and then comes the picture of how it looked after it came out of the machine. Then comes the dial in which they are to write + or -. Let the children finish page 8 and do page 9 independently. Then discuss their answers.

When you discuss their answers, ask how many stripes, stars or whatever you added on or take away.

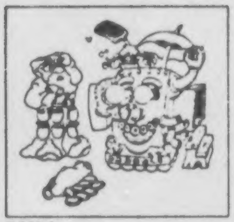
The Unput-Putter

Twice upon a time, sometime tomorrow or the day after, there lived a preposterous inventor. His name was Mr. D. Zine. He lived in a preposterous house which suited him perfectly.


23H-a

Stop. Show card 23H-a.

One morning, he started to build a new invention. He hammered, pasted, scissored, glued, screwed, folded, wrenched, and finally finished his latest creation. Stepping back to admire it, he realized that he hadn't the faintest idea what kind of machine it was or what it was for.


23H-b

Stop. Show card 23H-b.

"Oh, catfish! What am I going to do with this machine when I don't know what it does?" he muttered to himself.

"Guess!" a voice sputtered. It was the machine talking.

"Blithering barnacles! You talk?" asked Mr. D. Zine.

"Yes," sputtered the machine.

"Well then, I'll guess what you do. Are you a grape deseeder?" -- "No."

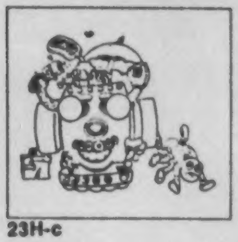
"Are you a ladybug baby-sitter?" -- "No."

"Are you a cobweb dry cleaner?" -- "No."

"Do you make roller skates for snails?" -- "No."

Poor Mr. D. Zine. He kept guessing until he lost his voice, but no luck. He couldn't guess the purpose of his marvelous (but mysterious) machine.

Meanwhile his pet spider, Alice, crept up to the machine to get a closer look. She was peering into one of the machine's many tubes when, all of a sudden--slurp! She was sucked into the machine. She felt something very strange happening, but she couldn't tell what. Then the machine spit her out.



23H-c

Stop. Show card 23H-c.

And guess what! She was covered with eight lovely pink spots!

"Fantastic!" she squeaked.

"Aha! So that's its secret!" chortled Mr. D. Zine. "It puts on spots!"

"Just then Sam, the skunk, stepped up to the machine and was slurped into it. A minute later he came out, but he had no stripe!

"Now I know. You put on spots and stripes and things sometimes, and sometimes you unput them. I shall call you an Unput-Putter," said Mr. D. Zine.

"That's what I am," sputtered the machine.

From then on the Unput-Putter was a tremendous success! People came from great distances to put their pets through Mr. D. Zine's machine.

But there was a problem. No one knew if the machine would add on or take away spots, stars, or stripes.

So, Mr. D. Zine decided to put a dial on the machine. He hammered, drew, and printed until he had a dial that said, "PUT" and "UNPUT." That worked fine for awhile. Friends who wanted to add on stars, stripes, or spots turned the dial to "PUT." Friends who wanted to take away spots, stripes, or stars turned the dial to "UNPUT."

Then all of a sudden the machine quit working.

"What's the matter?" asked Mr. D. Zine.

"Matter? Matter?" sputtered the machine. "Oh, aches and pains! It's that dial. It's so big it gives me a headache and it takes some people a long time to read it. Please find a better way to say 'put' and 'unput.' I just can't work."

Well, Mr. D. Zine thought and thought, but he was stumped. What could he do?

Just then Mr. D. Zine heard a knock at the door.

"Oh catfish," he said. "Here's someone to use the machine and it isn't working." But it wasn't someone who wanted to use the machine. It was a short person with a purple cape and a briefcase.

"Salutations. My name is Symbol Simon and I'm here to solve your problem," squeaked the stranger.

"I have just the right symbols for you. For people who want to add on, use this sign on the dial," he said and he opened one side of his cape.

Stop. Show card S1B-a.

"For people who want to take away, use this sign on your dial," he said as he opened the other side of his cape.

Stop. Show card S1B-b.

"Oh, thank you! Thank you!" said Mr. D. Zine. Then he built a new dial and everyone, even the Unput-Putter was happy.

ACTIVITY S1 C

In this activity the children choose or write phrases to represent joining and separating situations.

Objectives

1 writes open + or - sentence 0-20

2 solves $a + b = \square$ sentence 0-10

3 solves $a - b = \square$ sentence 0-10

Organization

large group, individual

Materials

Student Booklet pages 10 and 11

Preparation

No special preparation.

Teaching Suggestions

Read the story "Instructions for the Unput-Putter." (TG page 22) Then discuss the following examples of instructions Mr. D. Zine could give the machine.

1. Telly Turtle had seven spots. She wanted to have three of them taken off.
    a. What instructions could Mr. D. Zine give the machine? (7 - 3)
       Some children may want to write 3 - 7. Use objects to show that this doesn't make sense. Set out 3

objects or draw 3 spots on the chalkboard and ask if you can take seven away.

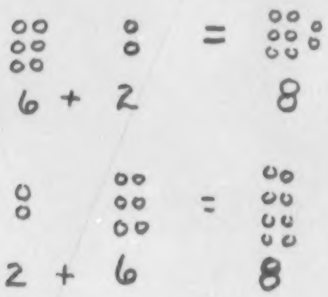
b. How many spots did Telly have after she came out of the machine? (4)

Use objects to solve. Set out 7 links saying, "She had 7 spots." Then take away 3 saying, "She had three taken away." Count how many are left.

2. Doris' pet snake, Slim, had six stripes. He wanted two more stripes.

a. What instructions could Mr. D. Zine give the machine? (6 + 2)

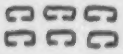
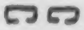
Some children may want to write 2 + 6. Ask if 6 + 2 and 2 + 6 represent the same number. Use objects or pictures on the chalkboard to show that they do.



Tell the children to use the phrase that makes the the most sense to them.

b. How many stripes did Slim have after he came out of the machine? (8)

Use links to show children how to solve.

 add on  count to 8.

Student Booklet pages 10 and 11. Begin by going over the first problem on page 10. For this example, physical modeling with links is suggested.

How many dots did the ball have to start with? (5--set out five links)

Were dots added on or taken away? (added on)

How many? (4)

What instructions or phrase would that be? (5 + 4) Circle it.

Let's see how many spots the ball would have then. (Join 4 more links with the 5 and count to get 9. Or join and count saying we have 5 and adding on 4 more gives us six, seven, eight, nine!)

The ball would have 9 spots after it came out of the machine. Let's record that on the box. Write 9 in the box.

Do another one or two examples from pages 10 and 11 as you think necessary. Then let the children finish the pages on their own.

INSTRUCTIONS FOR THE UNPUT-PUTTER

One day Mr. D. Zine decided that there had to be a better way to use the Unput-Putter. He wanted to be able to tell the machine exactly how many spots, stripes, or stars to add on or take away.

"Is that possible?" Mr. D. Zine asked the machine.

"Possible? Possible?" repeated the machine. "Well, maybe, but it would have to be very clear to me. I wouldn't want to get confused," sputtered the machine.

"Oh, I'll be careful not to confuse you," said Mr. D. Zine as he patted the machine. "Let's see. I have a teapot that has 4 dots on it. I'd like 3 of those dots taken off."

"What? What?" said the machine. "Take off 4 dots?"

"No, no, take off 3 dots," shouted Mr. D. Zine.

"But you said 4 dots," said the machine.

"Oh catfish!" exclaimed Mr. D. Zine. "Look, I'll write it down on paper and put the paper in this slot by your dial." And so he did. This is what he wrote.

Stop. Write on board. 4 - 3

The machine took the paper and read it.

"Oh well, this is easy. The teapot starts out with 4 dots and I take away 3. That's easy. Why didn't you say so?" chuckled the machine. "Why, if you give me pieces of paper like this, I don't need a dial."

So Mr. D. Zine took off the dial and gave the machine pieces of paper instead, with instructions written in numbers and symbols.

ACTIVITY S1 D

In this activity and the following optional one, the children practice writing phrases that represent joining and separating situations, as well as solving those problem situations. In this activity numerousness is used. In E, length and weight are used.

Objectives

1 writes open + or - sentence 0-20

2 solves a + b = ☐ sentence 0-10

3 solves a - b = ☐ sentence 0-10

Organization

large group

individual

Materials

Student Booklet pages 12 and 13

links

cubes

Preparation

No special preparation.

Teaching Suggestions

In this activity the children write phrases to describe joining and separating situations presented in stories. They also solve.

Student Booklet page 12. Give each child 20 links or cubes. Read the following story problems with the children. For each story they are to write a phrase and then solve to find the answer. Point out that when things are added on the sum or result of the joining is bigger than either set being joined. Also point out that when things are taken away the remainder is less that what you had when you started.

At this point you could also discuss the phrases 7 + 0 or 7 - 0 and what they mean. For example, if the story was:

> Mr. D. Zine had 7 nails. He went to the store, but didn't buy anymore. How many did he have them? (7 + 0 $\boxed{7}$)

Throughout the work on this page, discuss various solution strategies children may be using. Although physical modeling is recommended, encourage children to try different methods. Whenever possible, give praise to those children who may "know" a particular number fact, indicating that that is a particularly good, quick and efficient way to solve problems.

Introduction: Mr. D. Zine discovered that he could use the same kind of messages that he was giving the Unput-Putter to keep track of what happened to supplies in his workshop. For example, in one can he had 15 snaps. He used 7 of them on the Unput-Putter. What do you think he wrote down? (15 - 7) How many snaps did he have left in the cup? (8)

STORIES

1. Nails. Mr. D. Zine had 6 nails in a pocket. He put in 7 more nails. How many did he have then? (6 + 7 $\boxed{13}$)
2. Pins. Mr. D. Zine had 9 pins. Mrs. Hmhm, his neighbor, gave him 5 more pins. How many did he have then? (9 + 5 $\boxed{14}$)
3. Bolts. Mr. D. Zine used 8 bolts to make a chair. If he had 12 before he made the chair, how many did he have left? (12 - 8 $\boxed{4}$)
4. Nuts. 10 wing nuts were in a jar. 6 were used. How many wing nuts are still in the jar? (10 - 6 $\boxed{4}$)
5. Screws. Mr. D. Zine had 10 screws. His pet spider found 10 more. How many screws altogether? (10 + 10 $\boxed{20}$)
6. Chips. Mr. D. Zine used 4 wood chips to make a doll. He used 9 wood chips to make a puppet. How many chips did he use altogether? (4 + 9 13)
7. Cups. Mrs. Hmhm had 9 bottle caps. She gave 3 to Mr. D. Zine. How many did she have left? (9 - 3 $\boxed{6}$)
8. Links. Mr. D. Zine's pet skunk used 9 links to measure his tail. He used 9 more to measure his body. How many links did he use to measure both? (9 + 9 $\boxed{18}$)
9. Tacks. There were 11 tacks in a can. Mr. D. Zine used 6 to patch the Unput-Putter. How many tacks were left in the can? (11 - 6 $\boxed{5}$)
10. Snaps. There were 7 snaps in a can. Mr. D. Zine bought 7 more. How many snaps altogether? (7 + 7 $\boxed{14}$)

Now do an example from Student Booklet page 13 and let the children finish the page independently. Save pages 12 and 13 for later use in Activity S1F.

ACTIVITY S1 E

(Optional)

In this activity the children practice writing and solving phrases that represent joining and separating situations. The situations involve some measurement.

Objectives

1 writes open + or − sentence 0-20

2 solves $a + b = \square$ sentence 0-10

3 solves $a - b = \square$ sentence 0-10

Organization

large group

pairs

Materials

Student Booklet pages 14 to 17

links

small washers

balances

clay

Preparation

Set up 8 to 10 weight stations (or as many as you have balances for). At each station have 5 objects labeled G, H, R, S, T. (You may use lumps of clay.) Have small washers for weighing. Each object should weigh from 3 to 10 washers.

Teaching Suggestions

Begin by explaining that the instructions or phrases that Mr. D. Zine gives the machine can be used to record what happens with any adding on or taking away.

Student Booklet page 14. This page asks the children to measure and then to join and separate using chains of links obtained from measuring. Give each child page 14 and a pile of links. After the children have measured their necks and wrists, they need only look at what was recorded for measurements in order to "Make N" or "Make W" as directed. Do the page with the children, making sure they record both phrases and answers.

Student Booklet pages 15 and 16. Page 15, which is similar to 14 should be done by part of the children while the others are weighing the 5 objects at the weight stations and recording weights on page 16. Then they switch. When all children have completed page 15 and the weighing, do the joining and separating questions on page 16 as a large group.

Student Booklet page 17. This page is similar to 16, except that the weighing has been done. The children may complete page 17 independently.

ACTIVITY S1 F

In this activity the children are introduced to writing mathematical sentences ($a \pm b = \square$) to represent joining and separating situations. They also solve sentences.

Objectives

1 writes open + or - sentence 0-20

2 solves $a + b = \square$ sentence 0-10

3 solves $a - b = \square$ sentence 0-10

Organization

group (Part 1)

individual (Part 2)

Materials

Student Booklet pages 18 and 19 (Part 2)

cubes, links (Parts 1 and 2)

Vocabulary

$\square$ (something)

= review

Preparation

No special preparation.

Teaching Suggestions

The children are ready to deal with complete mathematical sentences. This activity introduces the complete sentence and gives the children the opportunity to choose, write, and solve sentences that represent joining and separating situations. Do both parts.

Part 1 Begin by reading the following problem to the children:

> A monkey had six spots. The Unput-Putter gave him two more. How many did he have then?

Write $6 + 2 = \square$ on the board saying, "The moneky had 6 spots. Two more were added on; that equals something."

Explain to the children that you have written a sentence on the board that describes the story. Ask them if they remember writing sentences before--shorter ones. ($m = n$, $m \neq n$, $6 = 6$, $7 \neq 3$.)

Ask someone to read this sentence. $6 + 2 = \square$. (Six plus two equal something.) Stress that the $= \square$ is read as "equals something," rather than "equals box."

Then ask what would go in the box to make the sentence true. (8) Use links to prove $6 + 2 = \boxed{8}$.

Go back to Student Booklet pages 12 or 13. Have the children write sentences or put in the equal signs between the phrases and the $\square$'s to make sentences.

Then do as many of the following problems as you think necessary with the children. Memorization of ± facts is not expected. Explain that when they are finding out the number that goes into the box, they are solving the sentence.

Before doing the problems, however, review this problem solving sequence with the children:

1. Decide whether it will be a + or - situations.
2. Write appropriate phrase.
3. Then write $= \square$.
4. Finally, solve by finding the answer using whatever strategy is appropriate and then writing numeral in $\square$.

1. Symbol Simon decided he wanted more symbols on his cape. He had 8 and the machine added 7 more. How many did he have then? ($7 + 8 = \boxed{15}$ or $8 + 7 = \boxed{15}$)
2. A huge beetle with 17 spots on its back went through the Unput-putter. 8 spots were taken away. How many were left? ($17 - 8 = \boxed{9}$)
3. Mr. D. Zine had 20 cents. He bought a new pencil for 13¢. How much money did he have left? ($20 - 13 = \boxed{7}$)
4. Mr. D. Zine had 6 screw drivers. Mr. Umhm gave him 4 new ones. How many did he have then? ($6 + 4 = \boxed{10}$, $4 + 6 = \boxed{10}$)

Part 2 In this part the children use Student Booklet pages 18 and 19 to choose, write and solve sentences that represent joining and separating situations. Do as many examples as you think necessary. Then let the children work independently. You may also want to discuss problem F ($9 + 0 = \square$) as a group.

On page 19 check to see that the children are writing sentences correctly. A potential type of error that could occur is writing $8 = 7 - \boxed{1}$ for $8 - 7 = \boxed{1}$.

ACTIVITY S1 G

This activity gives children additional practice in writing open sentences about joining and separating situations.

Objectives

1 writes open + or - sentence 0-20

2 solves $a + b = \square$ sentence 0-10

3 solves $a - b = \square$ sentence 0-10

Organization

large group (Part 1)

pairs (Part 2)

Materials

large washers (Part 1)

pencils (optional) (Part 1)

blank paper (Parts 1, 2)

objects such as solids, cubes, and links (Part 2)

Student Booklet pages 20 to 22 (Part 3)

Preparation

Part 1 Cut up enough small slips of paper for about one-third of the large group. Write a single number from 0-10 on each piece of paper.

Part 2 Set up at least one station for each pair by placing 1 to 20 objects at each station. At half of the stations, separate the objects into two sets by putting one set on a piece of paper and the other set off the paper. For example, you could separate nine objects by putting six on the paper and three off the paper. At the other stations, put all the objects on the paper.

Teaching Suggestions

In this activity the children write and solve open sentences that describe joining and separating situations involving numerousness. You may do any or all parts. In Part 1 the children move from partner to partner and in Part 2 pairs move from station to station. In Part 3 the children work individually on Student Booklet pages.

Part 1 Provide each child in two-thirds of the large group with 1 to 10 washers. He can put them on a pencil so that he can carry them with him as he moves around the room. Provide each child in one-third of the group with a slip of paper with a number written on it. Also give each child a blank piece of paper on which to write open sentences.

The children move about the room seeking partners--each child with washers pairing either with a child with a slip of paper or with another child with washers. Two children with slips of paper do not qualify as partners. When a child with washers pairs with a child with a slip of paper, the number on the slip tells how many washers the children are to take away. Each child writes an open sentence to describe the situation and then solves. For example, if one child has eight washers and the other child has a 3 written on his slip, then write the sentence $8 - 3 = \square$, take three washers away from the eight to find that five are left, and complete the sentence $8 - 3 = \boxed{5}$.

When a child with washers pairs with another child with washers, the two children write a sentence about putting together their sets in either order and put the washers together to solve. After making the recording, each child retrieves his own washers, finds a new partner, and repeats this procedure.

After a period of time, change the group so that children who had the slips of paper have washers. Otherwise, the children with the slips of paper would never write a sentence to describe a joining situation.

Part 2 Give each pair of children a sheet of paper. The pairs move from station to station writing open sentences about the situations at each station. If there are two sets at a station, the two children write an open sentence about adding the set off the paper to the set on the paper, join the sets to solve, and complete the open sentence. They leave the objects on the paper after they have joined them and move on to another station.

If a station has only the set on the paper, one child decides how many objects to take away. The two children write an open sentence, take the number of objects they decided upon off the paper, and complete the sentence. They should leave the sets separated and move on to another station. Thus, at a given station, the objects alternate being all on the paper and some on and some off. As a result, different pairs of children will write different sentences.

If some of the objects are misplaced as the children work at the station, the total number of objects at a station will change. Do not worry about it. What is important is to observe the children writing the open sentences to see that they accurately represent the joining or separating situation at their station.

Part 3 On Student Booklet pages 20-22, the children choose or write sentences and then solve. They should use objects to help them solve. Remember, that no memorization of facts is expected in this topic.

S1 PROGRESS CHECK (TOPIC INVENTORY)

This is not a Topic Inventory, for mastery of stated objectives is not expected. This is merely a progress check to give you information on how the children are progressing. It also provides necessary data for Coordinated Study #1, involving the sentence writing topics. Please give the children's completed pages to Connie Cookson.

Objectives

writes correct sign + or -

writes sentence 0-10

Organization

large group

Materials

pages A and B

pencils

Time

approximately 10-15 min.

Instructions

1. Give each child pages A and B.
2. When giving the progress check, read the directions for each item at least twice. Repeat the directions as many times as you think necessary.

Directions to children

Print your name at the top of the first page--page A.

(Pause)

1. Find number 1, at the top of the page. Look at the dog. It went through Mr. D. Zine's Unput-Putter machine. Decide if spots were added on or taken away. Write the correct sign in the dial.

(Pause)

2. Find number 2. Look at the boot that went through the machine. Decide if squares were added on or taken away. Write the correct sign in the dial.

(Pause)

3. Find number 3. Look at the hat that went through the machine. Decide if dots were added on or taken away. Write the correct sign in the dial.

(Pause)

4. Find number 4. Look at the leaf that went through the machine. Decide if stars were added on or taken away. Write the correct sign in the dial.

(Pause)

5. Find number 5. Look at the mushroom that went through the machine. Decide if stripes were added on or taken away. Write the correct sign in the dial.

(Pause)

Turn to the next page--page B. Write your name at the top.

(Pause)

6. Fine number 6. Look at the set of stars. Next to them it says, "add on 3." Write a sentence with an equal sign and a box that tells about the story. You do not have to solve.

(Pause)

7. Find number 7. Look at the set of fish. Next to them it says, "take away 2." Write a sentence with an equal sign and a box that tells about the story. You do not have to solve.

(Pause)

8. Find number 8. Look at the set of bees. Next to them it says, "I went away." Write a sentence with an equal sign and a box that tells about the story. You do not have to solve.

(Pause)

9. Find number 9. Look at the set of bugs. Next to them it says, "2 more came." Write a sentence with an equal sign and a box that tells about the story. You do not have to solve.

(Pause)

10. Find number 10. Look at the set of birds. Next to them it says, "5 go away." Write a sentence with an equal sign and a box that tells about the story. You do not have to solve.

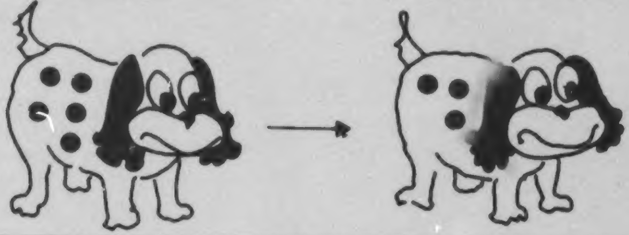
(Pause)

A

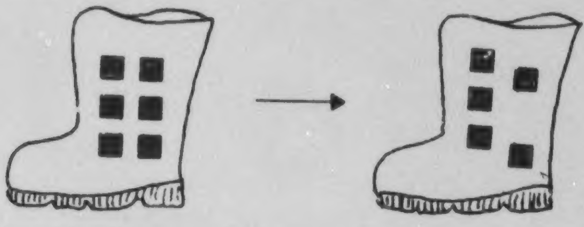
Name ______________________________

BEFORE	AFTER	DIAL

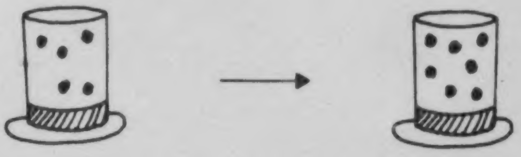
1.



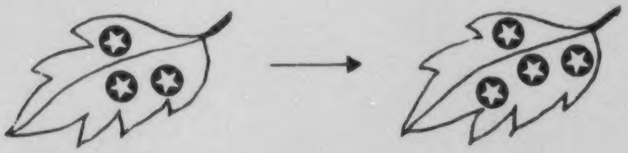
2.



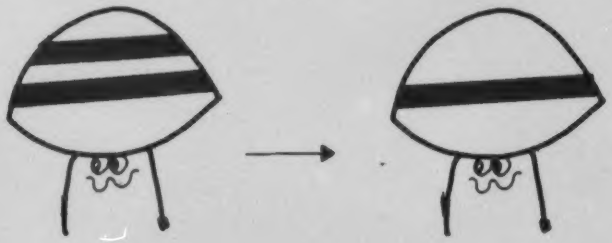
3.



4.



5.



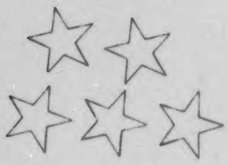
Progress Check (Topic Inventory) for S1

____
Name

B

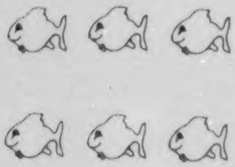
Write a sentence with a ☐ for each story.

6.



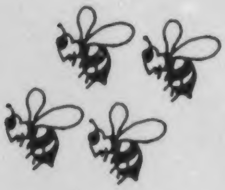
add on 3 ______________________

7.



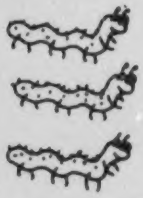
take away 2 ______________________

8.



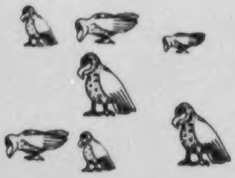
1 went away ______________________

9.



2 more come ______________________

10.

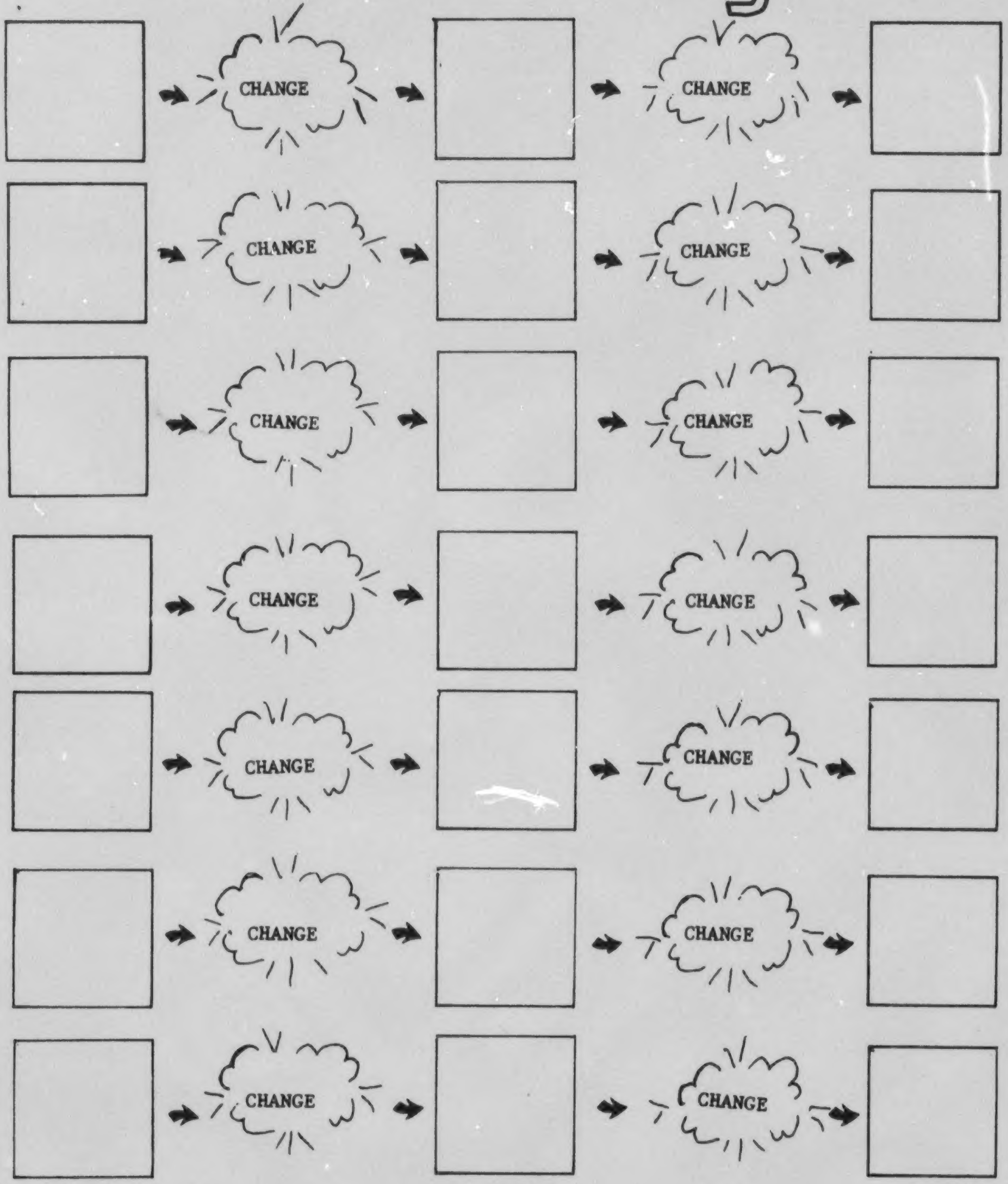


5 go away ______________________

Progress check (Topic Inventory) for S1

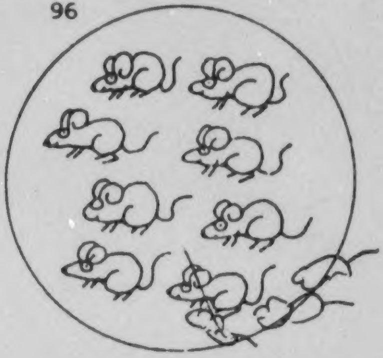
Answers will vary

Chain Change


CHANGE
CHANGE
CHANGE
CHANGE
CHANGE
CHANGE
CHANGE
CHANGE
CHANGE
CHANGE
CHANGE
CHANGE
CHANGE
CHANGE

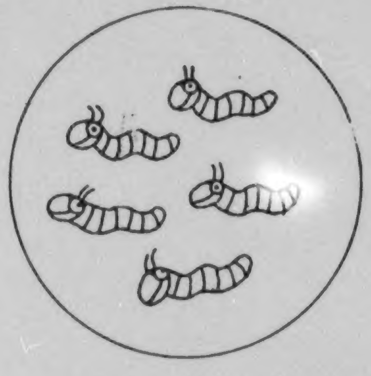
How many after the change?
Write the number in the box.

3



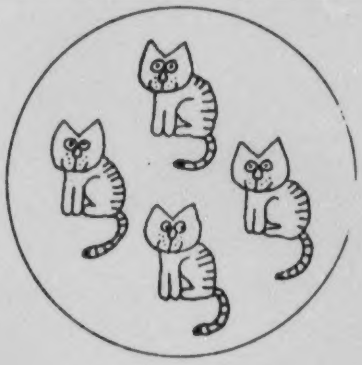
3 more mice come.

11



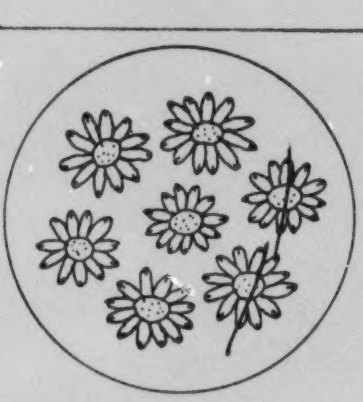
Add on 10.

15



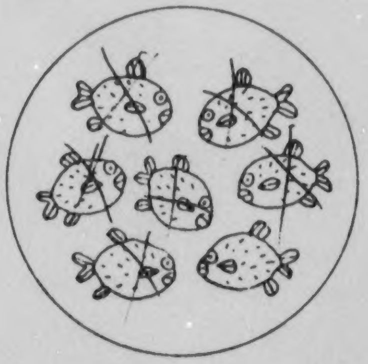
4 cats go away.

0



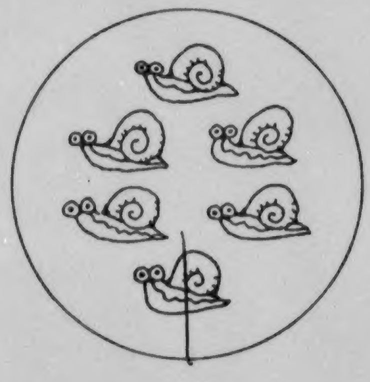
Take away 2.

5



6 fish go away.

1



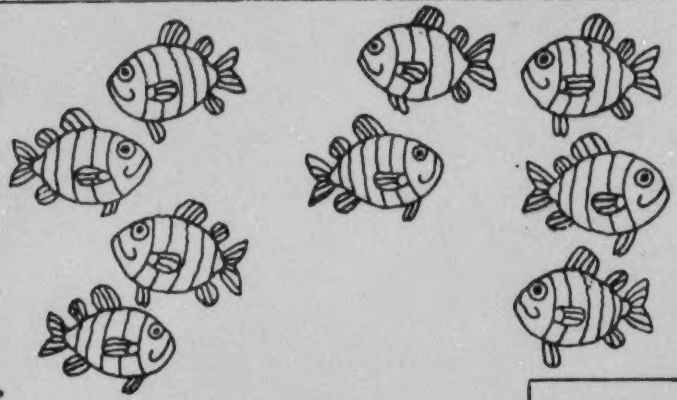
Take away 1.

5

A

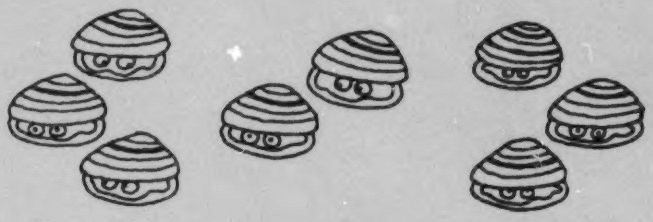
How many after the change?
Write the number in the box.

4



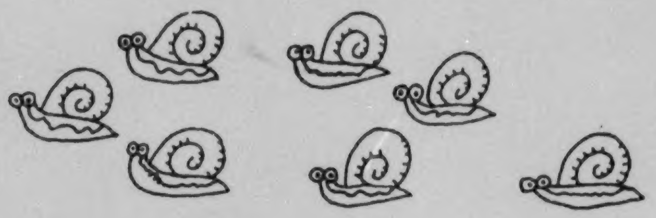
4 more fish come.

13



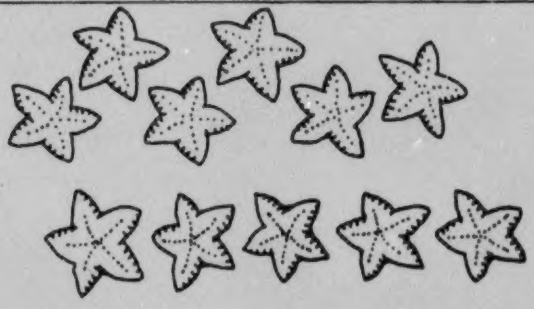
3 clams go away.

5



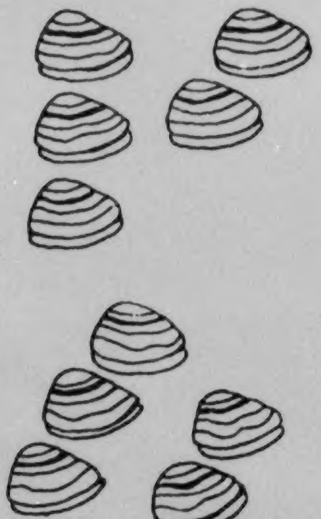
6 more snails come.

13



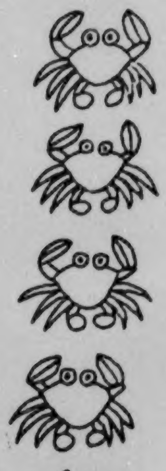
2 more starfish come.

13



5 clams go away.

5



12 more crabs come.

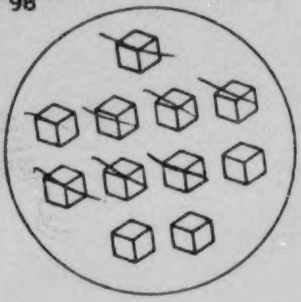
16

A

How many after the change?
Write the number in the □.

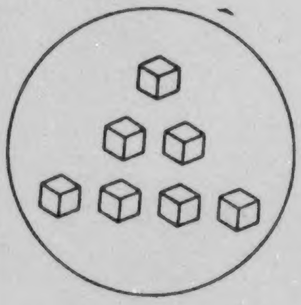
5

98



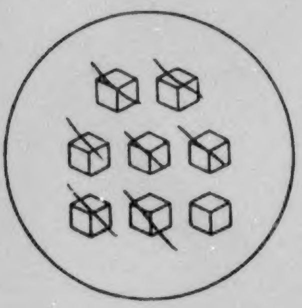
Take away 8.

$\boxed{3}$



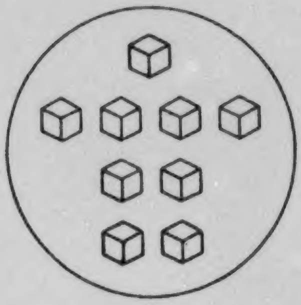
Add on 9.

$\boxed{16}$



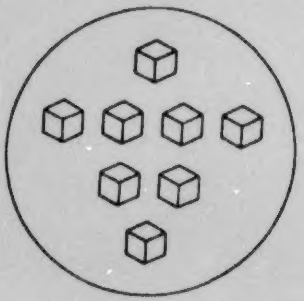
Take away 7.

$\boxed{1}$



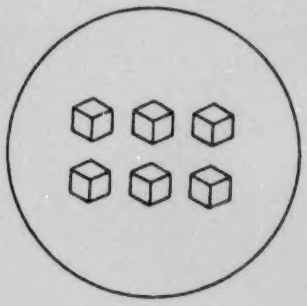
Add on 5.

$\boxed{14}$



Add on 6.

$\boxed{14}$

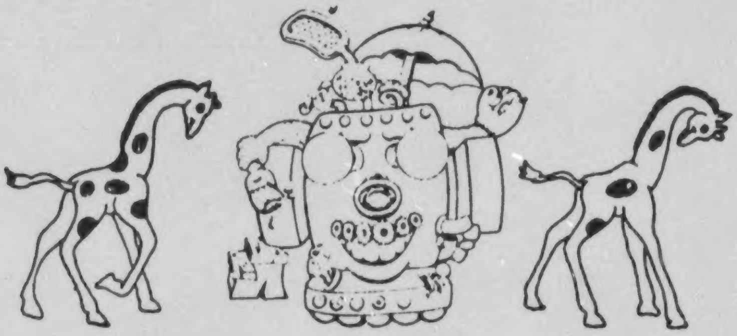


Take away 4.

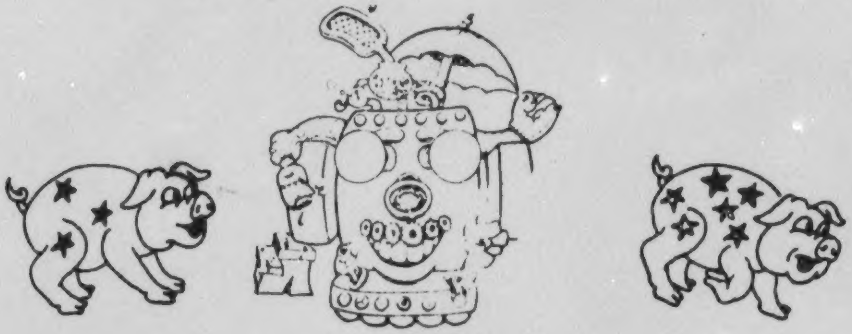
$\boxed{2}$

What happened? Circle the + or −.

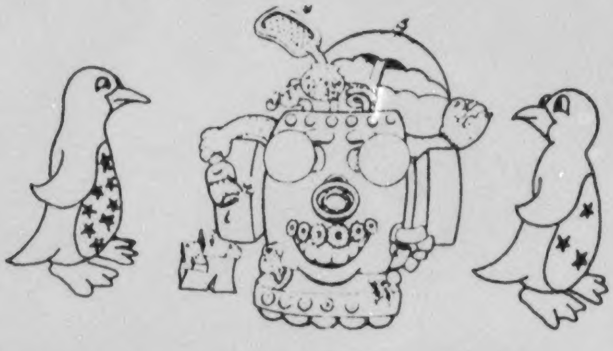
+ Add On
− Take Away



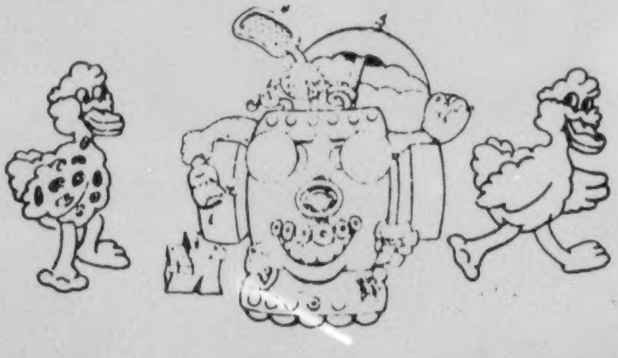
+ [✓ −]



[✓ +] −



+ [✓ −]

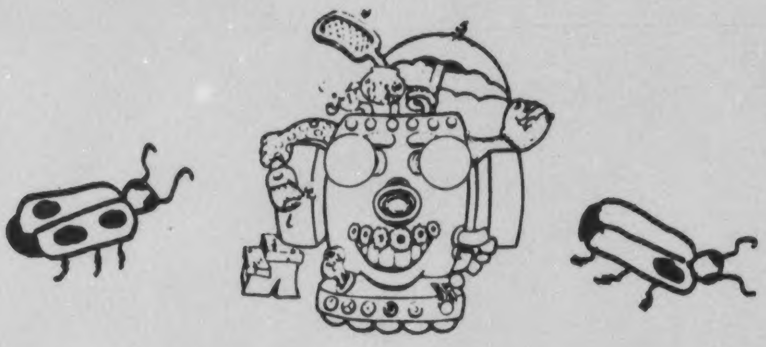


+ [✓ −]

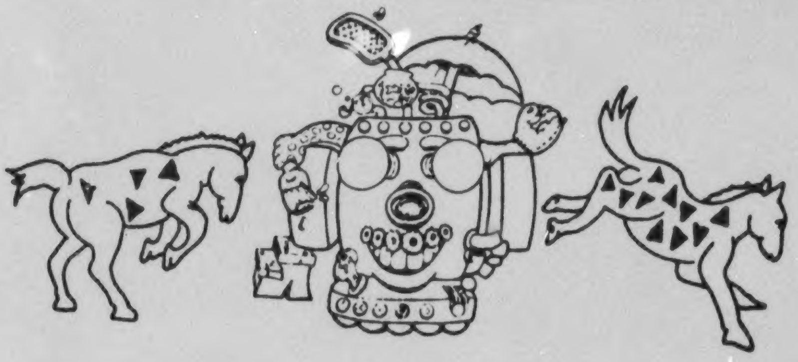
7

+ Add On
- Take Away

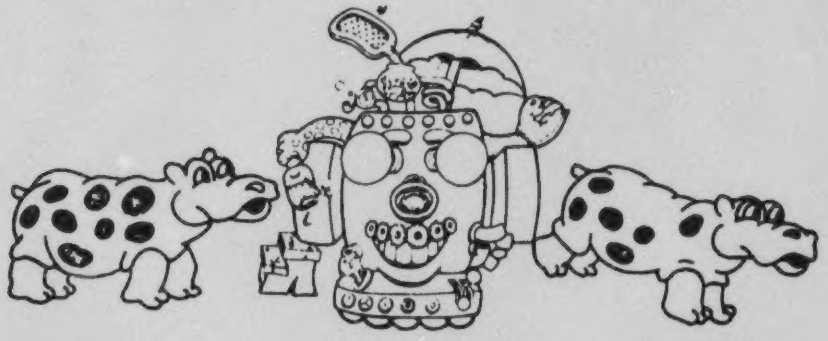
What happened? Circle the + or -.



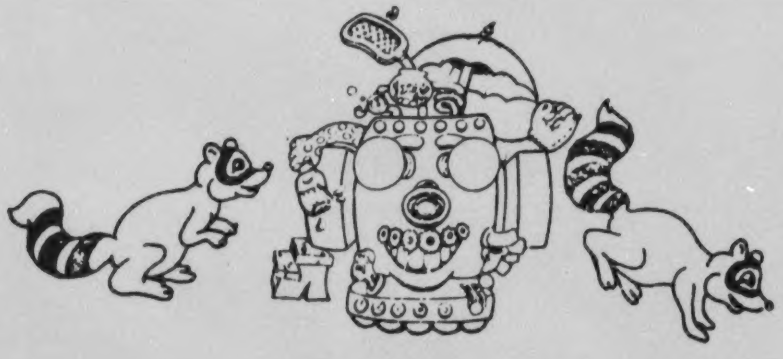
+ [✓ −]



[✓ +] −



+ [✓ −]



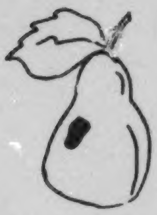
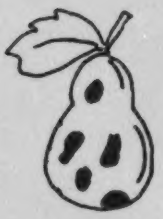
[✓ +] −

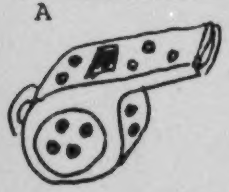
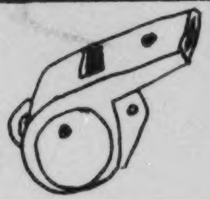
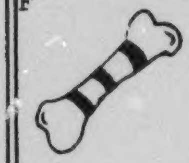
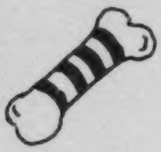
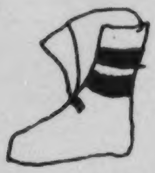
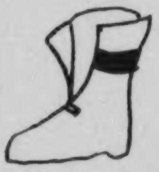
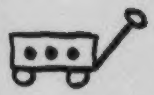
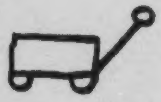
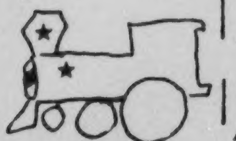
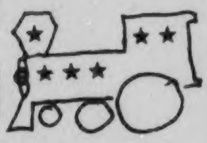
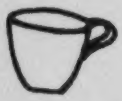
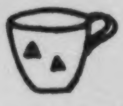
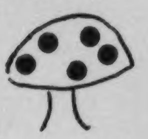
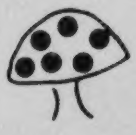
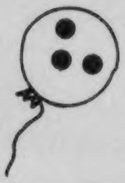
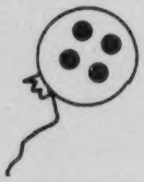
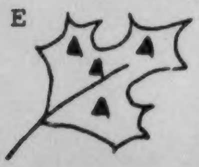
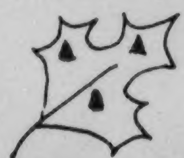
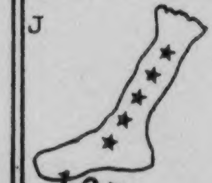
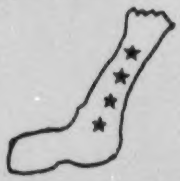
B

What happened? Put + or - in the ○.

+ Add On
- Take Away

EXAMPLE:

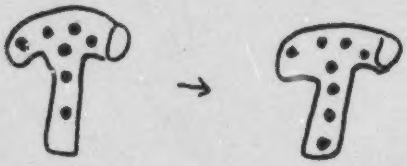
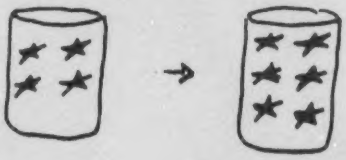
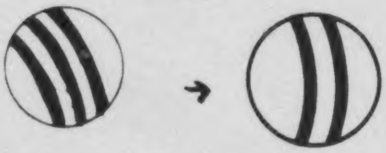
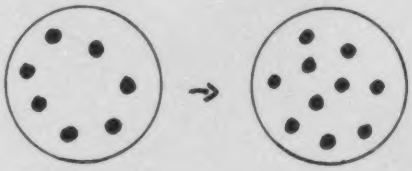
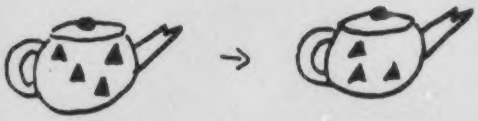
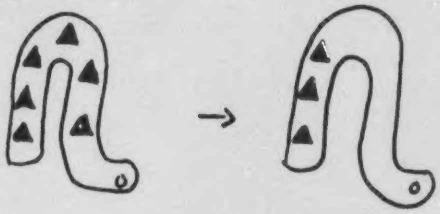
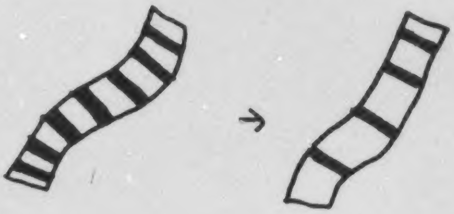
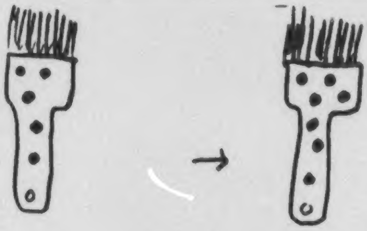
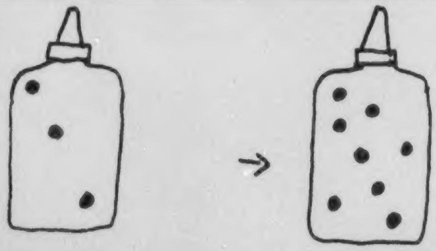
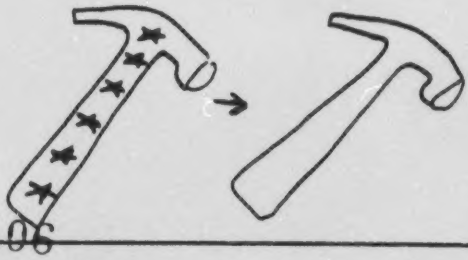
BEFORE		AFTER	DIAL
			+

BEFORE	AFTER	DIAL	BEFORE	AFTER	DIAL
A 		−	F 		+
B 		−	G 		−
C 		+	H 		+
D 		+	I 		+
E 		−	J 		−

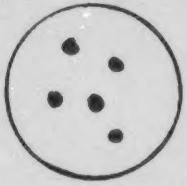
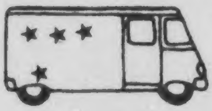
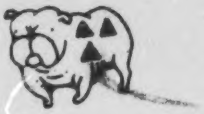
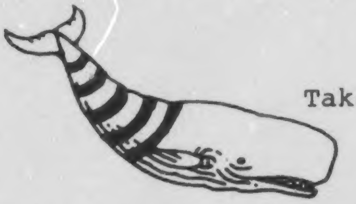
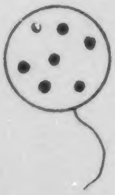
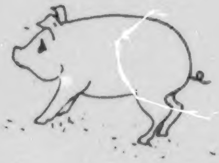
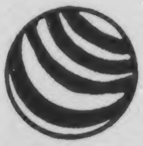
9

+ Add On
- Take Away

What happened? Put + or - in the ○.

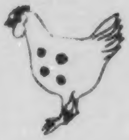
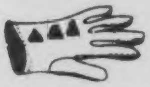
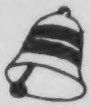
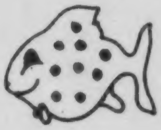
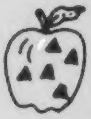
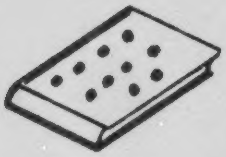
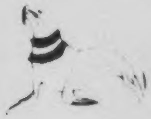
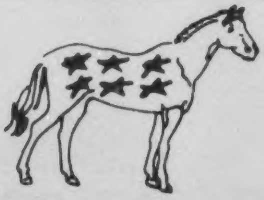
BEFORE AFTER		BEFORE AFTER	
	+		+
	−		+
	−		−
	+		−
	−		+
	+		−

8

Circle the correct instructions.		Instructions	How Many?
Example: 	Add on 4 dots	5 - 4 [✓ 5 + 4]	9
	Take away 2 stars	[✓ 4 - 2] 2 - 4	2
	Add on 3 ▲	[✓ 3 + 3] 3 - 3	6
	Take away 1 stripe	5 + 1 [✓ 5 - 1]	4
	Add 2 dots	[✓ 7 + 2] 7 - 2	9
	Add 7 stripes	0 - 7 [✓ 0 + 7]	7
	Take away 3 stripes	3 - 4 [✓ 4 - 3]	1

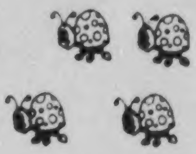
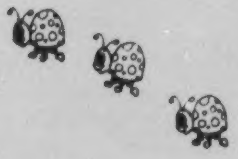
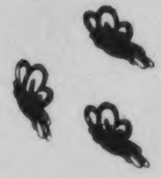
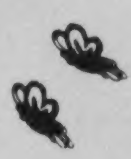
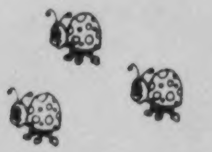
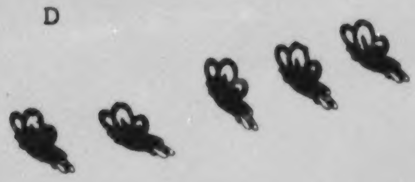
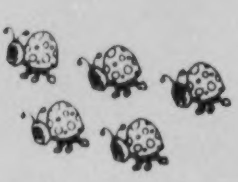
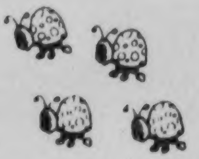
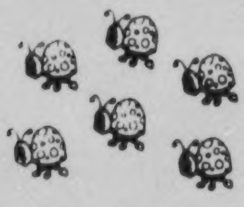
11

Write the instructions.

		Instructions	How Many?
	Add 6 dots	4+6	10
	Add 5 ▲	3+5	8
	Take away 1 stripe	2-1	1
	Take away 6 dots	9-6	3
	Add 3 ▲	5+3	8
	Take away 7 ●	10-7	3
	Add 1 stripe	2+1	3
	Take away 4 ☆	6-4	2

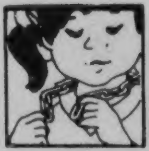
	Instructions	How Many?
nails	6+7	13
pins	9+5	14
bolts	12-8	4
nuts	10-6	4
screws	10+10	20
chips	4+9	13
caps	9-3	6
links	9+9	18
tacks	11-6	5
snaps	7+7	14

Write the phrase. Then write the number that tells how many after the change.

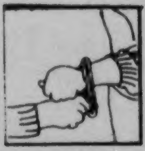
	BEGIN	CHANGE	PHRASE	How many after the change?
A		ADD ON 	4+3	7
B		TAKE AWAY 	3-2	1
C		5 MORE CAME	3+5	8
D		1 WENT AWAY	5-1	4
E		ADD ON 	5+4	9
F		4 WENT AWAY	6-4	2

How far around? Use 📎.

answers will vary



NECK



WRIST

N________________📎 W________________📎

Write a phrase about each problem. Then answer the question.

1. How long are N and W together? ____________________ ☐

2. How long would 2 N's be? ____________________ ☐

3. How long would 2 W's be? ____________________ ☐

4. Make N. Take off 2 📎. How long is it now? ____________________ ☐

5. Make W. Take off 3 📎. How long is it now? ____________________ ☐

6. Make W. Put on 0 📎. How long is it now? ____________________ ☐

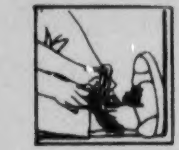
7. Make N. Put on 1 📎. How long is it now? ____________________ ☐

8. Make N. Take off 4 📎. How long is it now? ____________________ ☐

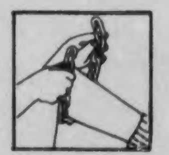
9. Make N. Take off 6 📎. How long is it now? ____________________ ☐

How far around? Use 📎.

answers will vary



ANKLE



KNEE

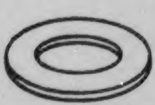
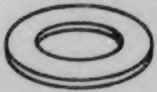
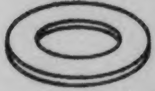
A ______________ 📎 K ______________ 📎

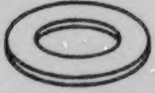
Write a phrase about each problem. Then answer the question.

1. How long are A and K together? ______________ ☐
2. Make A. Take off 3 📎. How long is it now? ______________ ☐
3. Make K. Put on 4 📎. How long is it now? ______________ ☐
4. Make A. Put on 1 📎. How long is it now? ______________ ☐
5. Make K. Take off 1 📎. How long is it now? ______________ ☐
6. Make K. Take off 0 📎. How long is it now? ______________ ☐
7. Make A. Take off 2 📎. How long is it now? ______________ ☐
8. How long are 2 A's? ______________ ☐
9. How long are 2 K's? ______________ ☐

How heavy? Use washers.

answers will vary

G is ____ 
H is ____ 
R is ____ 

S is ____
T is ____ 

Write a phrase about each problem. Then answer the question.

1. How heavy would G and H be together? ________________ ☐

2. How heavy would R and S be together? ________________ ☐

3. How heavy would S and T be together? ________________ ☐

4. Take 3 from R. How heavy is it now? ________________ ☐

5. Take 3 from S. How heavy is it now? ________________ ☐

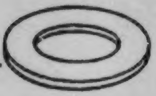
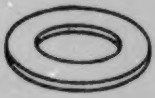
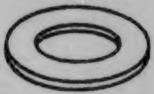
6. Take 3 from T. How heavy is it now? ________________ ☐

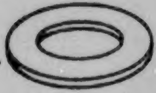
7. Take 1 from G. How heavy is it now? ________________ ☐

8. Take 2 from H. How heavy is it now? ________________ ☐

9. Add on 3 to H. How heavy is it now? 113 ________________ ☐

Mr. D. Zine weighed 5 objects in his shop.

A is 6  B is 2  C is 5 

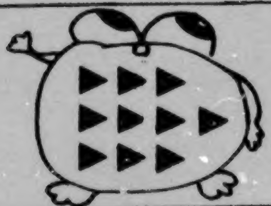
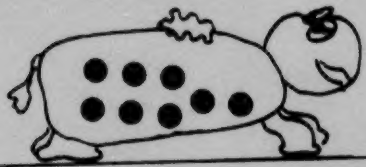
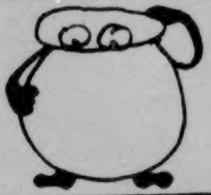
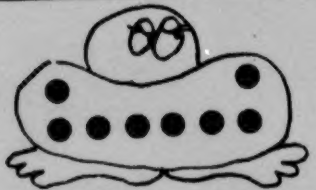
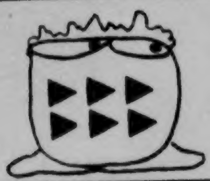
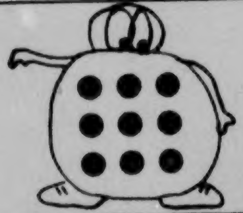
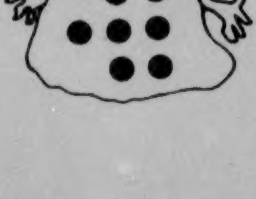
D is 4 E is 3 

Write a phrase about each problem. Then answer the question.

1. How heavy are A and B together?	6+2	8
2. How heavy are 2 B's?	2+2	4
3. How heavy are D and E together?	4+3	7
4. How heavy are B and D together?	2+4	6
5. Take 1 from B. How heavy is it now?	2-1	1
6. Take 3 from D. How heavy is it now?	4-3	1
7. Take 2 from C. How heavy is it now?	5-2	3
8. Take 4 from A. How heavy is it now?	~~6-4~~ 6-4	2
9. Take 0 from E. How heavy is it now?	3-0	3

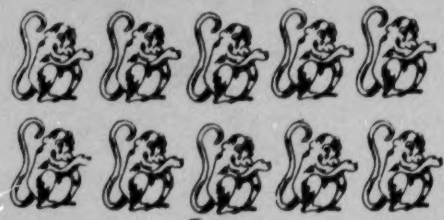
Circle the sentence that tells about the story. Then solve the sentence.

18
111

	Add on 6	10-6= ☐	[✓ 10+6= $\boxed{16}$]
	Take off 7	[✓ 8-7= $\boxed{1}$]	7-8= ☐
	Put on 9	9=0= ☐	[✓ 0+9= $\boxed{9}$]
	Add on 5	8-5= ☐	8+5= $\boxed{13}$
	Take away 6	[✓ 6-6= $\boxed{0}$]	6+6= [illegible]
	Put on 0	[✓ 9+0= $\boxed{9}$]	9-0= ☐
	Take off 4	4-7= ☐	[✓ 7-4= $\boxed{3}$]

Write a sentence with a □ for each story.
112 Then solve the sentence.

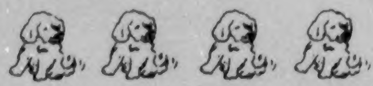
A



5 monkeys go away.

$10 - 5 = \boxed{5}$

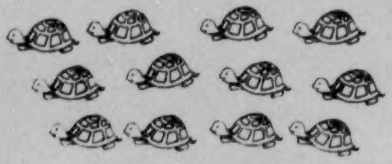
B



4 dogs go away.

$4 - 4 = \boxed{0}$

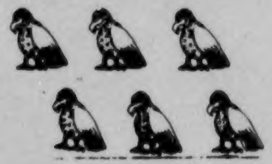
C



7 turtles go away.

$12 - 7 = \boxed{5}$

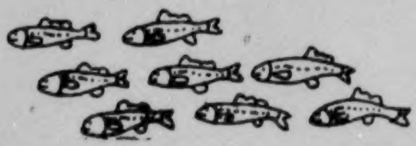
D



8 birds come.

$6 + 8 = \boxed{14}$

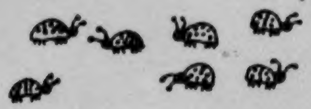
E



7 more fish come.

$8 + 7 = \boxed{15}$

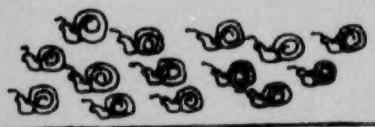
F



4 more bugs come.

$7 + 4 = \boxed{11}$

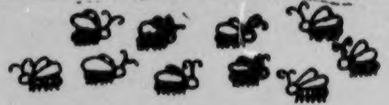
G



5 snails go away.

$14 - 5 = \boxed{9}$

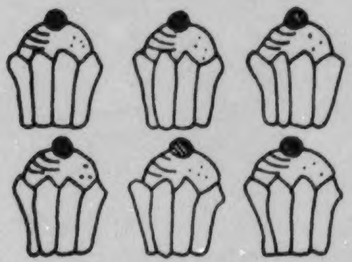
H



3 more bugs come.

$10 + 3 = \boxed{13}$

Circle the true sentence for each picture.
Then solve it.

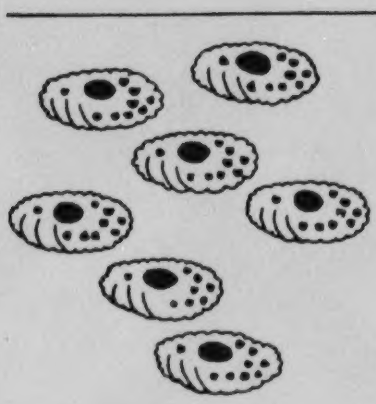


There were 6 cupcakes.
Martin ate 2.
How many are there now?

$6+2=\boxed{}$

$6=2-\boxed{}$

[✓ $6-2=\boxed{4}$]

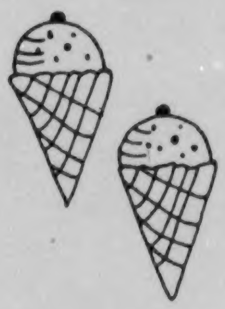


There were 7 cookies.
Franny made 1 more.
How many are there now?

[✓ $7+1=\boxed{8}$]

$7-1=\boxed{}$

$7=\boxed{}+1$

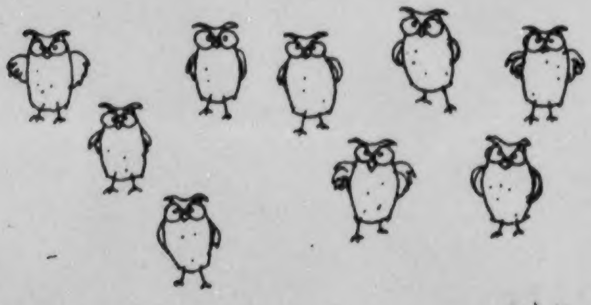


There were 2 ice cream cones.
Silly bought 3 more.
How many are there now?

$2-3=\boxed{}$

[✓ $2+3=\boxed{5}$]

$2+\boxed{}=3$



5 owls flew away.

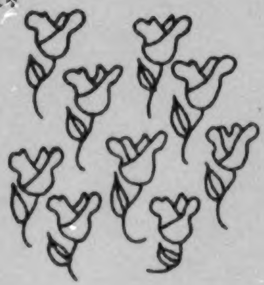
$9=5-\boxed{}$

[✓ $9-5=\boxed{4}$]

$5-9=\boxed{}$

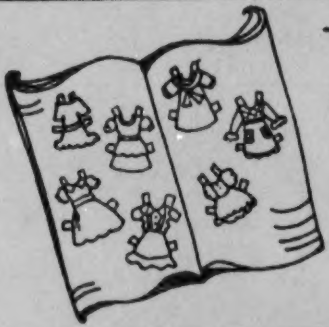
Write a sentence with a ☐ for each story.
Then solve the sentence.

114



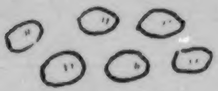
Ann picked 8
more flowers.

9+8 = $\boxed{17}$



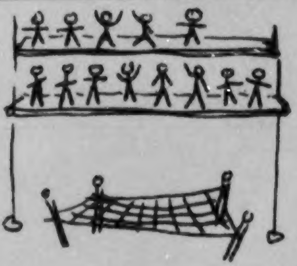
Tim cut out
2 dresses.

7-2 = $\boxed{5}$



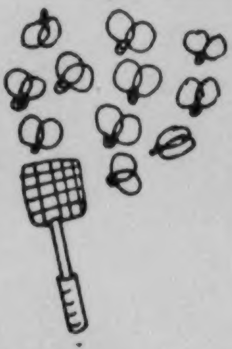
The hen laid
2 more eggs.

6+2 = $\boxed{8}$



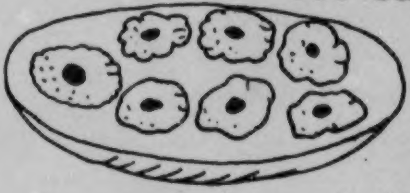
4 men jumped
into the net.

13-4 = $\boxed{9}$



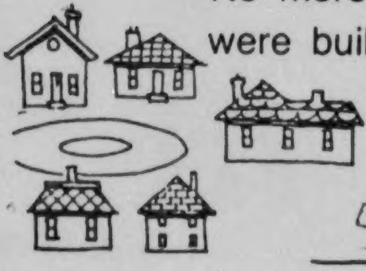
A man killed
5 of the flies.

11-5 = $\boxed{6}$



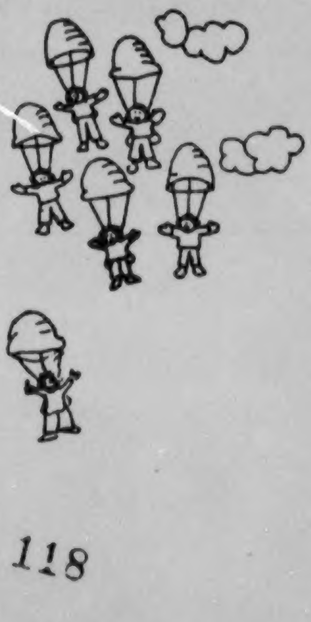
Joe baked 5 more
cookies.

7+5 = $\boxed{12}$



No more houses
were built on this block.

5+0 = $\boxed{0}$



8 more women
came.

6+8 = $\boxed{14}$

6

LL

Silly, Goofy, and Franny
went to the candy store.
Write a sentence with a □
about each story. Then solve it.
Use objects or pictures to help you.

Remember: dime = 10¢
Nickel = 5¢

1. Silly had 4¢ to spend.
He found a nickel on the sidewalk.
How much money did he have then? $4+5=\boxed{9}$¢

2. Goofy had 3¢ and then Franny
gave him 3¢ of hers to spend.
How much did he have to spend then? $3+3=\boxed{6}$¢

3. Franny had a dime.
She gave Goofy 3¢ to spend.
How much did she have left? $10-3=\boxed{7}$¢

4. Silly had 9¢.
He bought a lemon lollipop for a nickel.
How much money did he have left? $9-5=\boxed{4}$¢

5. Goofy had 6¢. He bought
a peanut candy bar for a nickel.
How much did he have left? $6-5=\boxed{1}$¢

6. Franny had 7¢. She bought
a nickel's worth of candy corn.
How much money did she have left? $7-5=\boxed{2}$¢

S1Aa

MAKE A CHAIN OF 9 📎 .

MAKE A CHAIN OF 4 📎 .

PUT THEM TOGETHER.

HOW MANY 📎 ALTOGETHER?

S1Ab

MAKE A CHAIN OF 9 📎 .

TAKE AWAY 4 📎 .

HOW MANY 📎 ARE LEFT?

S1Ac

MAKE A CHAIN OF 6 📎 .

ADD ON 7 📎 .

HOW LONG IS THE CHAIN NOW?

S1Ad

MAKE A CHAIN OF 6 📎 .

TAKE OFF 2 📎 .

HOW LONG IS THE CHAIN NOW?

S1Ae

MAKE A CHAIN OF 10 📎 .

MAKE A CHAIN OF 5 📎 .

JOIN THE CHAINS.

HOW MANY 📎 ALTOGETHER?

S1Af

MAKE A CHAIN OF 10 📎 .

TAKE AWAY 5 📎 .

HOW LONG IS THE CHAIN NOW?

S1Ag

MAKE A CHAIN OF 8 📎 .

ADD ON 3 📎 .

HOW LONG IS THE CHAIN NOW?

S1Ah

MAKE A CHAIN OF 8 📎 .

TAKE OFF 3 📎 .

HOW MANY 📎 ARE LEFT?

APPENDIX B

TOPIC S-2: SENTENCE WRITING: PART-WHOLE AND DIFFERENCE

TOPIC S2 SENTENCE WRITING: PART-WHOLE AND DIFFERENCE

OBJECTIVES

Preparatory

1. Given an open problem situation involving the numbers 0-20 that is solvable by using either addition or subtraction, writes a sentence that represents the situation. (writes open + or - sentence 0-20)
2. Given an open sentence of the form $a + b = \square$ or $\begin{array}{r} a \\ +\ b \\ \hline \end{array}$ involving the numbers 0-10, solves it. (solves $a + b = \square$ sentence 0-10)
3. Given an open sentence of the form $a - b = \square$ or $\begin{array}{r} a \\ -\ b \\ \hline \end{array}$ involving the numbers 0-10, solves it. (solves $a - b = \square$ sentence 0-10)

OVERVIEW

This is the second sentence writing topic. In the previous sentence writing topic (S1, the children were introduced to the + and - signs, then wrote phrases (2 + 3, 3 - 2) using the signs, and finally wrote sentences and solved them. ($2 + 3 = \boxed{5}$, $3 - 2 = \boxed{1}$). The situations presented were all joining and separating situations.

This topic reviews joining and separating and then introduces part-part-whole situations using the same "putting together" and "taking away" actions as those for joining and separating. Ultimately, in DMP, the children should be able to analyze all a[illegible]ion and subtraction situations by using the part-part-whole model. The two most important points in this model are:

1. The whole equals the sum of its parts.
2. The whole minus one part equals the other part.

The children begin by writing and solving sentences for part-part-whole situations where an action is implied. Since these situations closely resemble joining and separating situations, they should be easier initially for the children to analyze and represent than the part-part-whole situations where no action is implied. These latter situations are introduced in the second part of Activity B.

The part-part-whole model is used to describe the difference situation in terms of one-to-one matching. In the difference situation, there are two sets, the larger and the smaller. The larger set is the WHOLE. The smaller set is then matched one-to-one with elements of the larger set. This produced one part, the matched part. The remaining members of the larger set produce the other part or the unmatched part.

Also, in this topic the children are introduced to the following number properties and relationships.

1. Commutativity. $2 + 3 = 5$ and $3 + 2 = 5$
2. Properties of 0. $5 - 0 = 5$ and $5 + 0 = 5$
3. Families of sentences (Those whose whole and parts remain unchanged.) $2 + 3 = 5$, $3 + 2 = 5$, $5 - 2 = 3$, $5 - 3 = 2$.

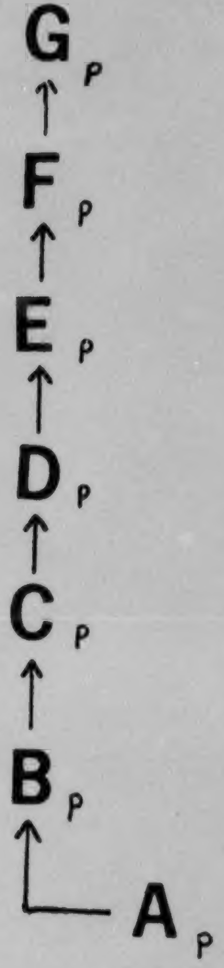
Many of the activities in this topic emphasize the 0-6 number facts. The children should begin to "know" by experience or memory that 1 + 2 = 3, 2 + 2 = 4, etc. It is not expected that all children will know all the facts. However, do praise those who remember them.

Also, the children will probably have their own systems for solving, counting, using objects, using fingers, using pictures or whatever. As the children solve the sentences in this topic, ask them how they arrived at their answers. If they have a method that consistently provides the correct solution and that they seem to understand, let them continue to use that method. Do not force them to count or model with objects. Do suggest these or crossing out methods with pictures to those children who have not learned or devised a satisfactory method of solving.

Validating is also reviewed on this topic. Throughout the topic, encourage the children to validate.

It should be noted that in this topic for the first time children see sentences without stories or situations. Periodically check to see that the children understand what a sentence represents by asking them to think of a story to go with the sentence.

SUGGESTED SEQUENCE CHART


G p
F p
E p
D p
C p
B p
A p

P= preparatory

ACTIVITY S2 A

Optional

This optional activity reviews writing and solving joining and separating sentences.

Objectives

Preparatory

1 writes open + or - sentence 0-20

2 solves $a + b = \square$ sentence 0-10

3 solves $a - b = \square$ sentence 0-10

Organization

individual, large group

Materials

Student Booklet pages 1 and 2

cubes or links

Preparation

No special preparation is needed.

Teaching Suggestions

This activity reviews writing and solving joining and separating sentences, which were introduced in Topic S1. Children may use objects or counting to solve.

Review the following strategy with the children:

1. Read the story.
2. Decide if you should add on or take away.
3. Write the sentence.
4. Solve.
5. Validate. Ask yourself if the answer makes sense.

Student Booklet page 1. The children write and solve sentences about sets of cubes. The first four pairs of problems are related. For example, the sentence for A is $2 + 4 = \boxed{6}$, and for B the sentence is $6 - 2 = \boxed{4}$. Praise those children who see the relationship, but don't stress it for those children who don't see or use the relationship. This will be done in more detail later in the topic.

Student Booklet page 2. This page which asks the children to write and solve sentences about sets of cartoon shapes should be done independently.

ACTIVITY S2 B

In this activity the children are introduced to writing and solving part-part-whole sentences.

Objectives

Preparatory

1 writes open + or - sentence 0-20

2 solves $a + b = \square$ sentence 0-10

3 solves $a - b = \square$ sentence 0-10

Organization

large group (Parts 1, 2, and 3)

individual (Part 2)

Vocabulary

part

whole

Materials

Student Booklet pages 3 and 4 (Part 2)

cubes (Parts 2 and 3)

Teaching Suggestions

This activity introduces the part-whole or part-part-whole situation, involving a set (the whole) and its two subsets (the parts). A sentence that represents such a situation does not necessarily describe an action. Instead, it represents the relationship between the whole and its parts. Basically, there are two ways to state this relationship.

1. The whole equals the sum of its parts.
2. The whole minus one part equals the other part.

The children should do all parts of this activity.

Part 1 This part introduces part-part-whole situations and how to represent them with open sentences. Discuss the following examples with the children.

Ask 7 boys and 5 girls to come to the front of the room. Then ask how many children there are altogether at the front of the room. Discuss the various counting strategies that could be used to find the answer.

1. Count everyone; 1,2,3, . . ., 11, 12.
2. Start with the known fact that there are 5 girls and "count on" the boys: 5, (pause), 6,7,8,9,10,11,12.
3. Start with the known fact that there are seven boys and "count on" the girls: 7, (pause), 8,9,10,11,12.

Explain that you have a set of children. One part of the set is boys and the other part of the set is girls. The two parts (boys and girls) make up or equal the whole (set of children). Have the children return to their seats.

Ask how many children would be in the set at the front of the room if you had 8 girls and 7 boys come up. (Don't have the children come yet.) Give them just a moment to think about it, then suggest that maybe you should write a sentence to show what is happening. Ask what sentence you should write.

($7 + 8 = \square$, or $8 + 7 = \square$) Ask again how many children altogether. Explain that when they find the number of children they will be solving the sentence. Record the answer in the box ($8 + 7 = \square$), and discuss the various ways the children found the answer: Have the children come to the front so that they can be counted or model the problem with cubes or tally marks.

Next, tell the children that you are going to have a set of 13 children go to the front of the room. (Without letting the children count, send 6 girls and 7 boys.) Then ask how many girls would be left if the boys sat down. Again ask what sentence you could write to show what is happening. ($13 - 7 = \square$). Then solve. You can solve by having the boys sit down and then count the girls or count backwards one by one as the boys sit down (13 left, 12, 11, 10, 9, 8, 7 6 left). Fill in the ($13 - 7 = \square$). Discuss any other solving methods the children suggest.

Ask what the sentence would be if you had the same group of 13 children, as above, but this time the girls sat down and you wanted to know how many boys were left. ($13 - 6 = \boxed{7}$) Solve the sentence as before.

Part 2 In this part the children write and solve part-part-whole sentences from word situations. Keep in mind the following two points.

1. When you know the two parts and you want to find out how many altogether, what do you do? (Add the two parts together.)

2. When you know the whole and one part and you want to find how many in the other part, what do you do? (Subtract the known part from the whole.)

When solving the problems, some children may know from experience that 6 - 2 = $\boxed{4}$. Praise these children, but let those who must solve by counting, representing with objects, or any other method that they have devised and that works for them.

Begin by reading the following story.

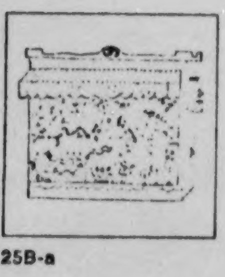
Sally Shark's Shop

Deep, deep under the sea in the town of Fishburg was a tiny little hat shop. The owner was named Sally Shark.

Hats were very popular in Fishburg, and Sally's shop was always busy. Almost every week Sally had to hire someone new to work for her because so many of the local fish wanted hats. Why, fish came for leagues to buy a hat at Sally's shop.

Sally had many kinds of fish working in her shop. There was Sam Sawfish, who used his toothy snout to cut out material and decorations. Shirley Swordfish poked holes in the hats with her long sword so that veils, pins, and all kinds of pretty ornaments could be attached. The fish in charge of ribbons and other such trimmings was Ricardo the Ribbonfish. Several little scallops trimmed the hats and cut lovely little designs around the edges. Most of the hard work was done by Sally's little helpers, the mussels.

Last but not least, Gertrude Goldfish was the clerk and operated the cash register.



25B-a

stop Show Picture 25B-a.

Read and discuss the following problems about Sally Shark's Shop. Have volunteers write and solve the sentences that represent each story. Use objects to represent hats, decorations, etc.

1. Ricardo made some bows.

   8 were red.

   3 were yellow.

   How many did he make?

Ask what information the story gives them. (He made 8 red bows.) Have one child hold up 8 red cubes. Ask if that's the whole number of bows he made. (No, it's only a part.) Ask what else the story tells. (He made 3 yellow bows.) Have another child hold up 3 yellow cubes. Ask if that's the whole. (No, it's a part.) Review by saying, "The story told us the two parts, 8 red, 3 yellow, and asks us to find the whole or how many altogether. What can I do to find that?" (Join or add on.)

Go through the problem solving strategy:

1. Read the story. (We did that.)
2. Decide if you add on or take away. (We decided to add on.)
3. Write the sentence. Have someone write the sentence on the board. ($8 + 3 = \square$ or $3 + 8 = \square$)
4. Solve. ($8 + 3 = \boxed{11}$ can be done by counting the cubes or any other method.)
5. Validate. (Does it make sense? If we put two parts together, add, will the answer be greater than either part? Is 11 greater than 8? Is 11 greater than 3?) You could also validate by recounting the cubes.

Discuss the following problem the same way.

2. Some helpers decorated a huge hat for a whale.

   9 scallops helped.

   4 mussels helped.

   How many helpers were there altogether? (9 + 4 = $\boxed{13}$ or 4 + 9 = $\boxed{13}$)

Go on to problem 3.

3. Shirley Swordfish had a hat with 12 decorations. Seven of the decorations were shells and the rest were pins. How many pins were there?

As what information the story gives. (The hat had 12 decorations.) Have a child hold up 12 objects. As if that is the whole number of decorations on the hat. (Yes.) Ask if it tells how many pins. (No.) Ask what else the story tells. (Seven decorations were shells.) Ask if that is the whole number of decorations. (No, it's only a part.) Review by saying, "The story told you the whole and one part and you have to find the other part. Do you think you will add on or take away? (Take away.) Ask someone to write the sentence. (12 - 7 = $\boxed{}$) Say, "The whole take away a part equals the other part. Twelve take away seven equals something. Will the something be bigger or smaller than the whole or 12?" (Smaller.) Then solve using objects.

Discuss problem 4 in the same way.

4. Gertrude reported that 15 hats were sold one morning. Eight were cowboy hats and the rest were top hats. How many top hats were sold? (15 - 8 = $\boxed{6}$)

Next look at Student Booklet pages 3 and 4. The children write and solve sentences. If you feel the children need to see examples, do the first and last problem on each page or just the first problem on each page. As the children do the problems, ask them to identify the whole and the parts. You may wish to have them model with cubes. For example, for problem A on Student Booklet page 3, a child could make a group of 4 objects, saying that it was the whole number of octopuses (or octopi) in the group. The child could then separate out a group of 3, saying that it was the part with hats. At this point the child should write the sentence 4 - 3 = $\boxed{}$, and then solve 4 - 3 = $\boxed{1}$, identifying the 1 as the part without hats.

Stress that the answer in the box should be the answer to the question the story asks.

Part 3 This part consists of a "Mystery Container" game. Have each child secretly prepare a container by putting 0-10 cubes or links of one color and 0-10 cubes or links of a second color in the container. Containers may have lids or the children may put a hand over the top so that no one else can see into the container.

Give each child a slip of paper with either a + or a -.

Next demonstrate how the game is played.

Children play the game in groups of 4 or 5. Each child in the group gets a turn to be "It." When "It," each child secretly looks at the slip of paper.

If the sign is +, he or she peeks in the container and gives the number of each color, for example, "I have 2 red cubes and 3 blue cubes. How many altogether?" The other children then must tell how many of the objects there are altogether (empty the objects from the container to check) and must decide if the person who is It has asked the "right" question for the sign (+).

If the sign is -, the person who is It peeks in the container and gives the total number of objects and the number of objects of one color. For example, "I have 11 links. 5 links are yellow. How many are blue?" The rest of the children in the group must tell how many objects there are of the second color (empty the container and count to check) and if the person who is It has asked the "right" question for the sign. (-)

Children may prepare new containers for new rounds of play.

ACTIVITY S2 C

In this activity the children measure length or weight and then write and solve part-part-whole sentences. This is somewhat harder than Activity B.

Objectives

Preparatory

1 writes one + or - sentence 0-20

2 solves $a + b = \square$ sentence 0-10

3 solves $a - b = \square$ sentence 0-10

Organization

large group, individual

Materials

Student Booklet page 5 (Part 1)

Student Booklet page 5 1/2 (Part 2)

Cards S2C a-p (Part 1)

links (Parts 1 and 2)

cubes (Parts 1 and 2)

10-link string (Part 1)

15-link string (Part 1)

13 small containers (Part 2)

small washers (Part 2)

masking tape (Part 2)

geometric solids (Part 2)

blank dice (Part 2)

1 large washer (Part 2)

Preparation

Part 1

Make a chain of links 3-5 feet long.

Cut 5-6 strings 10-20 links long.

Set up 12 length stations labeled a-ℓ (small letters corresponding to letters on Cards S2C a-ℓ. Put the corresponding Card S2C a-ℓ and 15 to 20 links or cubes (see cards) at each.

Part 2 (Optional)

Prepare the following small containers:

Inside	on masking tape on lid
large egg shaped geometric solid and 2 small washers	M Extra 2
rectangular solid and 6 small washers	N Extra 6
triangular solid and 7 small washers	O Extra 7
Half sphere and 9 small washers	P Extra 9
1 link and 8 small washers	Q Extra 8

1 large washer 4 small washers	R extra 4
1 of the blank dice and 5 small washers	S Extra 5
2 connecting cubes and 3 small washers	T Extra 3

Then set up 5 weight stations: at each have a balance, an empty small container, about 25-30 small washers, and one of containers M, N, O, P, or Q.

TEACHING SUGGESTIONS

This activity is somewhat more challenging than the preceding. The children write and solve part-part-whole sentences that represent situations using length. Part 2, involving weight, is optional.

Part 1. In this part the children measure lengths on cards, then write and solve part-part-whole sentences. Some problem solving techniques are involved.

Begin by taking the long chain of links and wrapping part of it around a chair (or a volunteer). Discuss what the children could measure easily. (The whole before anything is done with the chain and the part not wrapped around the chair.)

Pose the following problems:

1. Suppose I told you the length of the whole chain and you measured the part of the chain not wrapped around the chair. You would know a whole and a part. What could you do to find how long the other part is? (Subtract the part from the whole. $W - P = \square$)

2. Suppose I told you the length of the part of the chain that is wrapped around the chair and you measured the length of the part that isn't wrapped around the chair. You would know the two parts. What could you do to find the whole length of the chain? (Add the two parts together. $P + P = \square$)

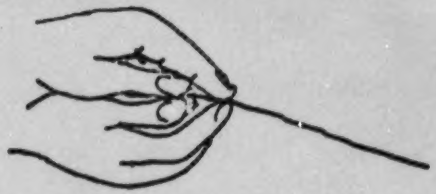
Some children may suggest marking how much of the chain is wrapped around the chair, unwrapping the chain and measuring for the first example, or unwrapping the chain and measuring its length for the second example. Accept these as good problem solving techniques, then go on by saying, "Suppose the chain couldn't be unwrapped . . ." and pose the two problems again.

Then read the following story.

THE STRANGE EARTHQUAKE

One night while Sally Shark and all her helpers were home and not at Sally's shop, a strange thing happened. There was a very small earthquake under Sally's hat shop. The walls and shelves shook and shook until all the hat decorations fell off the shelves. The string, lace, ribbon, and yarn drifted out the door that had been knocked open. Sally and her friends searched all the next day for the trimmings. They finally found them all, but some were in pretty strange places.

Now explain that one of the strings floated near a clam and the clam gobbled up part of the string. Have a volunteer come to the front of the classroom and cup his or her hands to make a clam. Stuff in part of a 10-link long string.



Explain that the string was 10 links long and you want to know how much of the string is in the clam. (Of course the clam won't open up to let you see.)

Ask what you know for sure. (The whole string is 10 links long.)

Pass out a copy of Student Booklet page 5 to each child. Explain the headings. Ask where on the chart you could record the information about the chain's length. (Under the WHOLE.) Ask if there is a way you could find one of the parts. (Measure the part not in the "clam.") Record it on the first PART column. For example:

WHOLE	PART	PART	SENTENCE
10	6		

Ask what you could do to find the other part. (Subtract.) Ask what sentence to write. (10 - 6 = ☐) Solve and check by measuring.

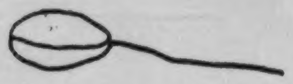
Next do an addition situation with a string and the clam. Stuff part of the string into the clam. Explain that the clam told you it swallowed 5 links of string. Ask if that is part of the whole string or the whole string. (Part) Ask if there is anything that could be measured. (The part not in the clam.) Measure it and have the children record. For example:

	WHOLE	PART	PART	SENTENCE
	10	6		10 - 6 = 4
→		5	7	

Ask what you could do to find the whole and what sentence to write. (Add 5 + 7 = $\square$) Have the children record and solve. (5 + 7 = $\boxed{12}$) Do not check by measuring the whole string.

Do 3 more examples with the strings. Mix addition and subtraction situations.

Next, do as many examples as you think necessary using pictures on the board.



Have the children record on the ditto. It might help to point out that there are two types of problems: the addition one when they know both parts and have to find the whole; and the subtraction one when they know the whole and a part and must subtract the part from the whole to find the other part. It may take several examples before the children understand this. Therefore, mastery of the concept is not expected at this point, but will come in later topics.

In analyzing the subtraction situations, you should point out that the whole is written first and the part is subtracted: W - P = ☐ Now introduce the station cards, Cards S2C a-p. Do cards a and b with the children. Have them record on Student Booklet page 5. Then, let the children go to the stations you have already set up. They record their sentences on Student Booklet page 5. The children may use "counting on" or objects to solve.

Part 2 (Optional). In this part the children write and solve sentences. They then order the "answers" to identify "mystery objects."

Begin by telling the children that the weight of each mystery container is made of two parts: the weight of the mystery object and the weight of extra small washers.

Use container R as an example. Read the top, "R extra 4." Explain that "extra 4" means that there are 4 extra small washers in the container, so you know that part of the weight is 4. Ask how to find the other part of the weight--the weight of the mystery object--without opening the containter. (Find the weight of the whole container and subtract 4 to find the mystery object weight.) Do so with R. Record work on the line by R on page 5 1/2. Have volunteers do S and T. Record work on page 5 1/2, for example S 9 - 5 = 4 washers. Guess what objects are in the containers and open the containers to check.

Next explain that the children are to find the weights of five mystery objects, those in containers M, N, O, P, and Q. If they do this correctly and then put the containers in order (heaviest to lightest) based on the calculated weights of the objects (record in the large box on the bottom of page 5 1/2), the pictures in the large box will tell what mystery object is in the container.

When all the children have weighed, calculated the weights of the mystery objects, put them in order, and recorded the order by writing the letter of the containers in the large box on page 6, open the containers to see if the pictures match the objects.

ACTIVITY S2 D

This activity introduces difference situations. The children write sentences to represent these situations and solve the sentences.

Objectives

Preparatory

1 writes open + or - sentence 0-20

2 solves $a + b = \square$ sentence 0-10

3 solves $a - b = \square$ sentence 0-10

Organization

large group (Part 1)

individual (Part 2)

Vocabulary

difference (review)

Materials

Student Booklet pages 6 to 9 (Part 2)

cubes (Parts 1 and 2)

Preparation

No special preparation needed.

Teaching Suggestions

After a child has ordered two lengths, sets, or weights and knows which is longer, bigger, or heavier, the next most reasonable question to ask is "How much longer (bigger, heavier)? This question focuses on difference and should not be new to the children. In previous topics the children were introduced to using one-to-one matching to represent and solve difference situations. This matching also fits the part-part-whole model. The whole is the larger of the two sets being compared. One part is the part of the larger set that matches one-to-one with the members of the smaller set. The other part is the part of the larger set that remains unmatched. So, the part that matches and the part that doesn't match (difference) make up the whole.

Part 1 Although the children are familiar with difference situations, this is the first time they have been asked to write sentences about them.

Begin with a review of difference situations using a rod of 9 cubes and one of four cubes. Ask the children which rod is longer. (9-cube) Ask how much longer it is. Most likely the children will guess or count the number of cubes on the long rod above those on the shorter rod and correctly report the difference in length as 5 cubes. Next ask the children how they could describe or tell about the difference between the two rods by writing a sentence. In order to help the children write the sentence, have them focus on what was done. Lead them to see that they matched the cubes on the short rod with cubes on the long rod. Thus, they separated the whole long rod into two parts, the part that matches the short rod and the part that doesn't.

Use what the children learned about part-part-whole situation to write a sentence about what the unmatched part is equal to, that is: the long rod, 9, minus the matched part, 4, equals the unmatched part. $9 - 4 = \boxed{}$.

Do a couple more examples with lengths, having the children write and solve sentences.

Then do at least one example that doesn't depend on length. For example, call up a set of eight girls and five boys and ask how many more girls there are than boys. Match five girls with the five boys and then write a sentence about the unmatched girls. $8 - 5 = \boxed{3}$.

Part 2 This part consists of 4 student booklet pages about difference situations.

Student Booklet pages 6, 7 and 8 present sets of pictures. The children write a sentence that tells how to find the difference and then solve. Let the children count, use objects to solve, write on the paper to match, or whatever they have devised that works for them.

Student Booklet page 9. The children write a sentence (and solve) about pair of coins or amounts of money. Explain to the children that they are to write a sentence to show how to find how much more. This means finding the difference. Check to see that they write 6 - 3 = □ rather than 3 - 6 = □. Remind the children that a nickel = 5¢ and a dime = 10¢.

ACTIVITY S2 E

In this activity the children write and solve difference sentences that describe situations using the attributes of height, weight, and length.

Objectives

Preparatory

1 writes open + and - sentence 0-20

2. solves a + b = ☐ sentence 0-10

3 solves a - b = ☐ sentence 0-10

Organization

individual (Parts 1 and 2)

Materials

Student Booklet page 10 (Part 1)

Student Booklet page 11 (Part 2)

Cards S2E a-ℓ (Part 1)

balances (Part 1)

geometric solids (Part 1)

connecting cubes (Parts 1 and 2)

Preparation

Part 1 Set up 12 stations

6 height (Cards S2E a-d, i, j) with appropriate solids and several connecting cubes

6 weight with cubes, balance, and appropriate solids (see Cards S2E e-h, k, ℓ).

Teaching Suggestions

In this activity the children write and solve difference sentences describing situations that use the attributes of height or weight. The children may work in pairs on the stations in Part 1 or half the children may do Part 1 while the other half do Part 2. Then switch.

Part 1 In this part instructions on cards present situations and ask the children to write and solve sentences about differences involving solids. Cubes are used as units of measurement. You may wish to demonstrate what to do at each of the two types of stations. Cards S2Ea-d, i, j are about weight. Cards S2E e-h, k, ℓ are about height. As the children move from station to station, they may need additional help. All recording is done on Student Booklet page 10.

Part 2 Student Booklet page 11. (You may also make up some sheets of your own.) The children use lengths and weights given on a chart to write sentences and solve them. This will require careful matching.

ACTIVITY S2 F

In this activity the children are given open addition and subtraction sentences to solve. Emphasis is on the facts 0-6.

Objectives

Preparatory

1 writes open + or - sentence 0-20

2 solves $a + b = \square$ sentence 0-10

3 solves $a - b = \square$ sentence 0-10

Organization

individual (Parts 1 and 2)

large group (Part 2)

Materials

Student Booklet pages 12 and 13 (Part 1)

Student Booklet pages 14 to 16 (Part 2)

cubes (Parts 1 and 2)

scissors (Part 2)

crayons (Part 2)

glue (Part 2)

Preparation

No special preparation.

Teaching Suggestions

In this activity, for the first time in DMP, the children are given sentences to solve that are not associated with or derived from stories or situations. Also, the facts 0-6 are practiced, but mastery is not expected. Do both parts of this activity.

Part 1 This part consists of student booklet pages that the children complete independently.

Student Booklet pages 12 and 13. The children solve open sentences. See if they can solve without using objects or counting. If they cannot, let them who need to use other methods.

When they have finished, let each child choose a "secret" sentence from one of the pages. (For example, $5 - 1 = \boxed{4}$.) and make up a story or situation that the sentence could represent. (For example, "There were 5 cookies, a fox stole one. How many were left?"--separating or "There were 5 beans. One was black and the rest were white. How many were white?"--part-part-whole or "There were 5 logs in James' pile and 1 log on my pile. How many more logs does James have than me?") Try to get the children to give as many different types of stories as possible.

Part 2 This part consists of Student Booklet pages that require direction from the teacher.

Student Booklet page 14. Have the children solve the open sentences at the top of the page. Tell them that when they have finished they can color the design below. Colors are given below some answer boxes as a key for coloring. For example, $8 - 3 = \underset{\text{Blue}}{\boxed{5}}$ means that all the spaces in the design marked 5 are to be colored blue. When the children have finished coloring the design, they should be able to read the word ANT, which is the answer to the question above the design.

Student Booklet pages 15 and 16. First the children should solve the sentences on page 15. Then they carefully cut apart page 16 into its 15 puzzle pieces. The number on the face of each piece will match an answer on page 15 and should be placed over that sentence. When all the pieces are matched to sentences and glued, the puzzle will be assembled correctly.

ACTIVITY S2 G

In this activity the children are given further practice in solving open sentences. They also look at various number properties.

Objectives

Preparatory

1 writes open + or - sentence

2 solves $a + b = \square$ sentence 0-10

3 solves $a - b = \square$ sentence 0-10

Organization

large group

individual

Materials

Student Booklet pages 17 and 18 (Part 1)

Student Booklet pages ~~10~~ 19 and 20 (Part 2)

cubes (all parts)

Preparation

No special preparation.

Teaching Suggestions

In addition to solving open sentence in this activity, the children explore some number properties and relationships. Do both parts of this activity. Objects may be used to solve.

Part 1 In this part the children look at commutativity of addition. The word "commutativity" isn't used. Help them to realize that the order or adding two numbers doesn't matter.

Student Booklet page 17. On this page the children match sentences such as $2 + 4 = \square$ and $4 + 2 = \square$ then solve to see if they matched correctly. While the children do this page, pay special attention to those who have difficulty reading from left to right. Have these children read the sentence aloud: "Two and (plus) four equals something." Remember that the symbol, $\square$, is read as "something."

Student Booklet page 18. The children solve pairs of sentences. The orientation of each pair of sentences should make it easy for the children to see that the only difference between the sentences is the order in which numbers are added.

When the children finish the pages, you may discuss subtraction. Write these two sentences on the board and ask the children to read them.

$3 - 1 = \square$ "Three take away one equals something."
$1 - 3 = \square$ "One take away three equals something."

Ask the children to solve. If they solve $1 - 3 = \boxed{2}$ ask them to use cubes to show how they can take 3 away from 1. Lead them to see that it can't be done right now. Draw an X through the sentence $1 - 3 = \square$, saying that it doesn't make sense with what they know about numbers. Conclude that subtracting isn't like adding. You can't change the position of the numbers.

Part 2 In this part the children explore families of sentences. This can be a difficult concept for children, so don't expect all children to understand it. Beging by having the children do Student Booklet page 19, where they solve families of sentences. When they have finished, ask why each group of sentences is a family. (They use the same numbers. Some are just the sentence turned around. Some sentences are the opposite of others. They all have the same whole and the same two parts.) Look at one of the families. $2 + 3 = \square$, $5 = 2 = \square$, $5 - 3 = \square$, $3 + 2 = \square$. Use cubes to demonstrate that the same parts and the same whole is being "talked about" or represented in each sentence.

$2 + 3 = \boxed{5}$ Pick up 2 red cubes, saying "This is the red part. + 3 means add three more, or the blue part." Add 3 blue cubes to the 2 red. "That makes a whole of 5."

$5 - 2 = \boxed{3}$ Show the 5 rod you just made. Say, "The sentence says to take away 2 from the whole. So I take red part away from the whole to leave 3 or the blue part."

$5 - 3 = \boxed{2}$ Show the 5 rod. Say "The sentence says take 3 away from the whole. So I take the blue away, to leave 2 or the red part."

$3 + 2 = \boxed{5}$ "That sentence says put together the 3 part or blue part and the 2 part or the red part. That gives a whole of five."

Ask is the whole ever changed? (no) Was it always 5? (Yes) Did the red part change? (no) Was it always 2? (yes) Did the blue part ever change? (no) Was it always 3? (yes)

Do the same for another family. Then see if the children can make a family. Write the sentence $1 + 4 = \boxed{}$ on the board. Have them solve. Then ask for the other sentences in the family. Use cubes as a model. Help them to find the sentences.

$4 + 1 = \boxed{5}$

$5 - 4 = \boxed{1}$

$5 - 1 = \boxed{4}$

Next do Student Booklet page 20. On this page the children are given one sentence and are to write the other sentences in the family. This will be challenging for the children. Don't expect all the children to find all the sentences.

ACTIVITY S2 H

This activity reviews validating.

Objectives

Preparatory

1 writes open + or - sentence 0-20

2 solves $a + b = \square$ sentence 0-10

3 solves $a - b = \square$ sentence 0-10

Organization

individual

Vocabulary

validate (review)

Materials

Student Booklet pages 21 and 22

cubes or objects

Preparation

No special preparation is needed.

Teaching Suggestions

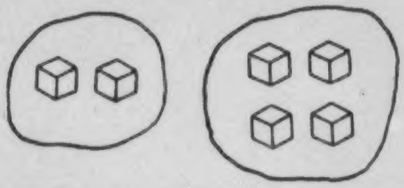
In this activity the children review the word "validating" and practice validating sentences. To validate means to show or to prove that the sentence is true. You may also need to review true and false sentences. Children may do this by representing the sentence with objects or pictures. For example, for 10 - 5 = $\boxed{5}$, the child may set out 10 cubes, remove 5 and count the remaining 5. Or he or she may draw 10 circles, cross out 5 and count the remaining 5.

Student Booklet pages 21 and 22. The children cross out wrong solutions and fix or correct them by rewriting the number in the solution box. As the children do the pages, check to make certain that they are validating rather than guessing.

name

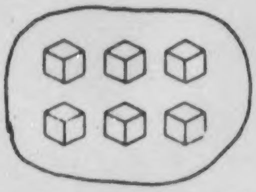
Write a sentence with a □. Then solve it.

A



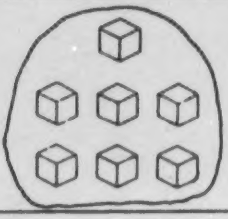
How many altogether?

B



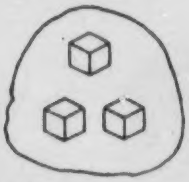
2 go away.
How many are left?

C



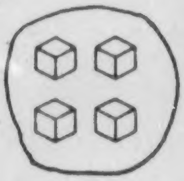
3 go away.
How many are left?

D



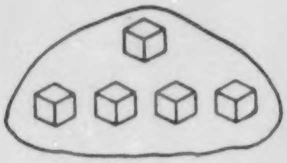
4 more come.
How many altogether?

E



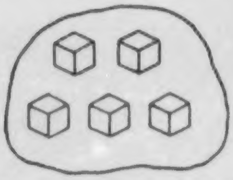
1 more comes.
How many then?

F



1 goes away.
How many then?

G



2 go away.
How many are left?

Directions for Topic Inventory for Topic S2. No mastery is expected.

Give this after Topic S2.

The completed pages should be given to Connie Cookson.

Read each of the 10 stories to the children. Give them time to write the appropriate sentence. Have them solve after they have written all 10 sentences. The children may use objects to help solve.

Next have the children solve the five addition and five subtraction sentences on page B. The children may use objects to help solve.

NAME ______________________

For each story write a sentence. Then solve it.

1. 4 red dots
   5 white dots
   How many dots altogether? ______________________

2. 8 balls
   2 are green
   The rest are blue.
   How many balls are blue? ______________________

3. 10 people
   7 are boys
   The rest are girls.
   How many of the people are girls? ______________________

4. 4 dogs
   1 is big.
   The rest are little.
   How many of the dogs are little? ______________________

5. 7 boys
   2 girls
   How many children altogether? ______________________

6. 4 eggs
   3 hens
   How many more eggs than hens? ______________________

7. 6 horses
   3 goats
   How many more horses than goats? ______________________

8. 5 ducks
   1 cat
   How many fewer cats than ducks? ______________________

9. 7 pigs
   2 cows
   What is the difference between the number of pigs and the number of cows? ______________________

10. 2 hats
    10 coats
    What is the difference between the hats and the number of coats? ______________________

Solve each of these.

1 + 2 = □ 0 + 6 = □ 4 + 2 = □

3 + 5 = □ 9 + 1 = □

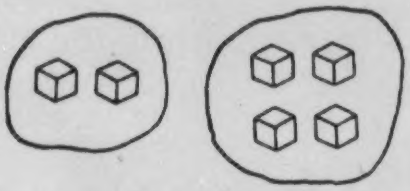
3 - 0 = □ 5 - 2 = □ 4 - 4 = □

10 - 6 = □ 7 - 5 = □

name________________________

Write a sentence with a ☐. Then solve it.

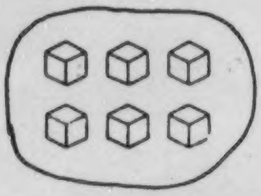
A



How many altogether?

$2+4=\boxed{6}$

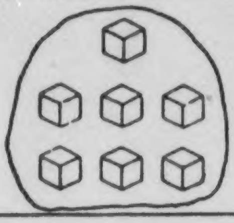
B



2 go away.
How many are left?

$6-2=\boxed{4}$

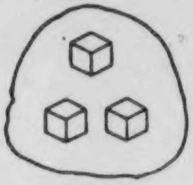
C



3 go away.
How many are left?

$7-3=\boxed{4}$

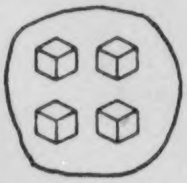
D



4 more come.
How many altogether?

$3+4=\boxed{7}$

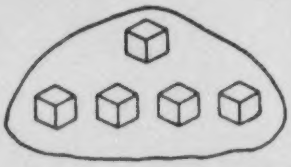
E



1 more comes.
How many then?

$4+1=\boxed{5}$

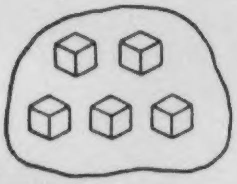
F



1 goes away.
How many then?

$5-1=\boxed{4}$

G



2 go away.
How many are left?

$5-2=\boxed{3}$

name ____________________

Write a sentence with a ☐. Then solve it.

A

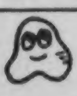
There were 8 .

6 go away.

How many are left?

$8-6=\boxed{2}$

B

There were 4  .

3 more came.

How many then?

$4+3=\boxed{7}$

C

There are 7 .

2 go away.

How many are left?

$7-2=\boxed{5}$

D

There are 12 .

2 more come.

How many altogether?

$12+2=\boxed{14}$

E

There are 9 .

4 more come.

How many then?

$9+4=\boxed{13}$

F

There are 16 .

7 go away.

How many are left?

$16-7=\boxed{9}$

G

There are 5 .

3 more jump in.

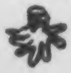
How many then?

$5+3=\boxed{8}$

name ______________________________

Write a sentence with a ☐ for each story. Then solve the sentences.

A

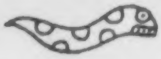
4  are in a group.

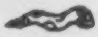
3 have hats. The rest do not.

How many do not have hats?

$4-3=\boxed{1}$

B

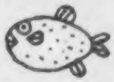


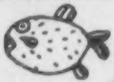
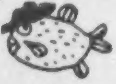
6  swim by.

1 does not have a hat.
The rest do have hats.
How many have hats?

$6-1=\boxed{5}$

C

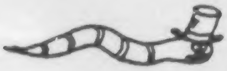


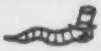
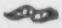
7  are with
7 other  .

How many altogether?

$7+7=\boxed{14}$

D

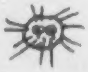


3  with hats
swim with 2  without hats.

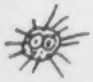
How many altogether?

$3+2=\boxed{5}$

E

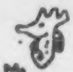
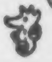
6  are in a group.

4 have hats. The rest do not.

How many  do not have hats?

$6-4=\boxed{2}$

F

5  without hats are with
6  with hats.

How many altogether?

$5+6=\boxed{11}$

52B pt 2

name

4

READ THIS FIRST

Write a sentence with a ☐ for each story. Then solve the sentences.

A

Sally's Hats

3 red hats.
4 blue hats.
How many altogether?

$3+4=\boxed{7}$

B

Sally's Hats

8 hats.
5 red, the rest green.
How many green Hats?

$8-5=\boxed{3}$

C

Sally's Hats

10 hats
4 yellow, the rest pink
How many pink hats?

$10-4=\boxed{6}$

D

Sally's Hats

6 gray hats
8 black hats
How many altogether?

$6+8=\boxed{14}$

E

Sally's Hats

5 white hats
2 orange hats
How many altogether?

$5+2=\boxed{7}$

F

Sally's Hats

14 hats
7 blue, the rest brown
How many brown hats?

$14-7=\boxed{7}$

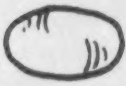
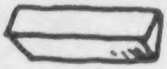
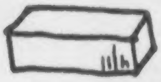
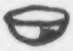
52B pt 2

STATION	WHOLE	PART	PART	SENTENCE
—				
—				
—				
—				
—				
a				
b				
c				
d				
e				
f				
g				answers vary
h				
i				
j				
k				
l				

52c pt1

5½

Station	Sentence
Example R	
Example S	
Example T	
M	answers vary
N	
O	
P	
Q	

Container Letter	Mystery Object
____ heaviest	
____	
____	
____	
____ lightest	

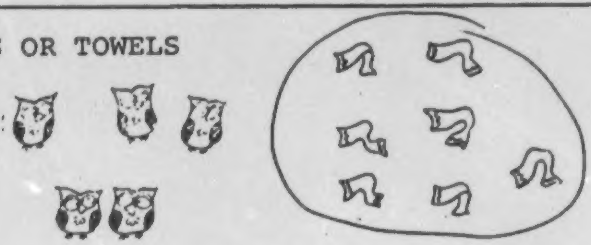
52c pt2

name

Which has more? Circle the larger group.

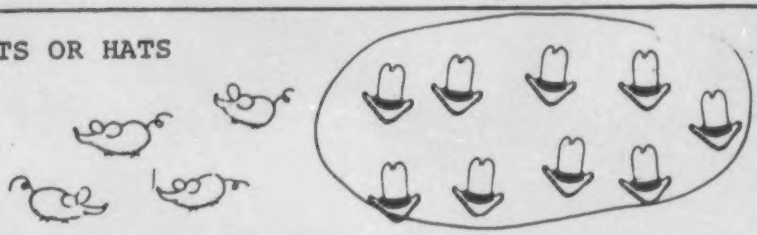
How many more? Write a sentence with a ☐. Then solve it.

OWLS OR TOWELS



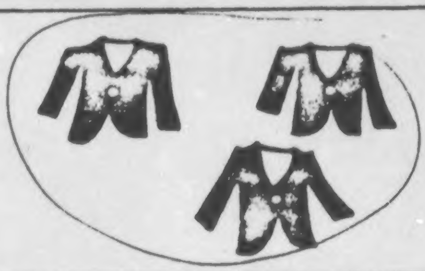
$7-5=\boxed{2}$

RATS OR HATS



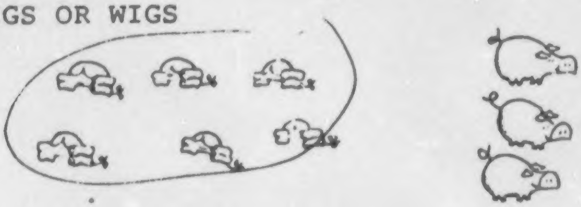
$9-4=\boxed{5}$

GOATS OR COATS



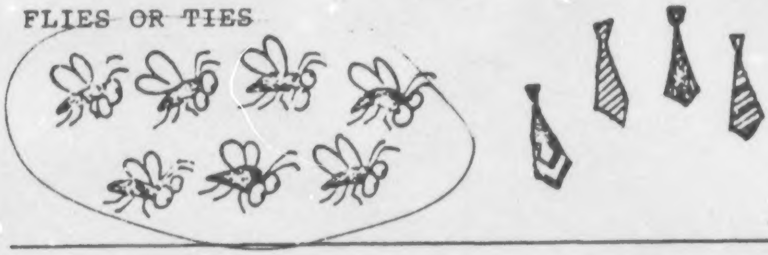
$3-0=\boxed{3}$

PIGS OR WIGS



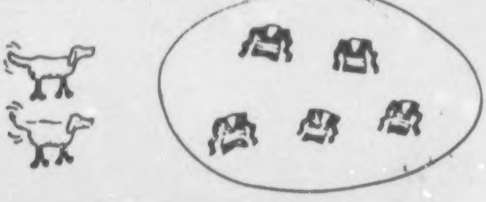
$6-3=\boxed{3}$

FLIES OR TIES



$7-4=\boxed{3}$

SETTERS OR SWEATERS



$5-2=\boxed{3}$

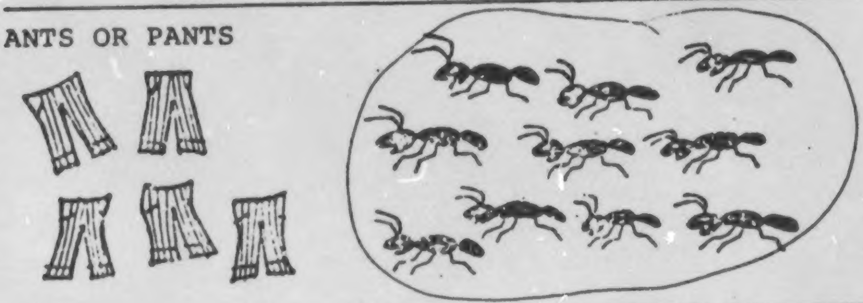
52D pt 2

name ________________ 7

Which is larger? Circle the larger group.

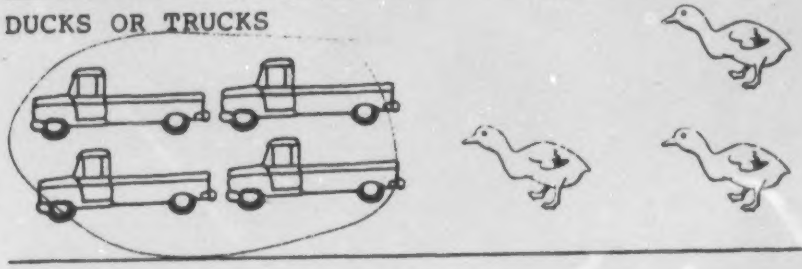
How many more? Write a sentence with a ☐. Then solve it.

ANTS OR PANTS



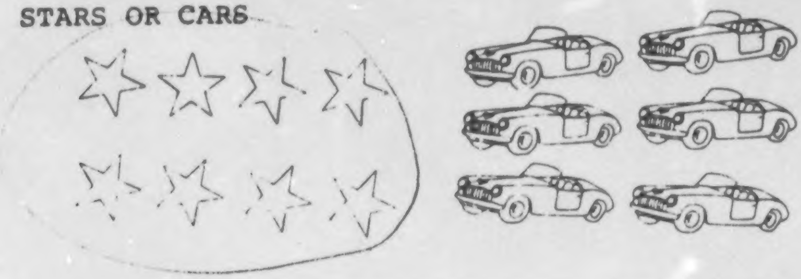
$10 - 5 = \boxed{5}$

DUCKS OR TRUCKS



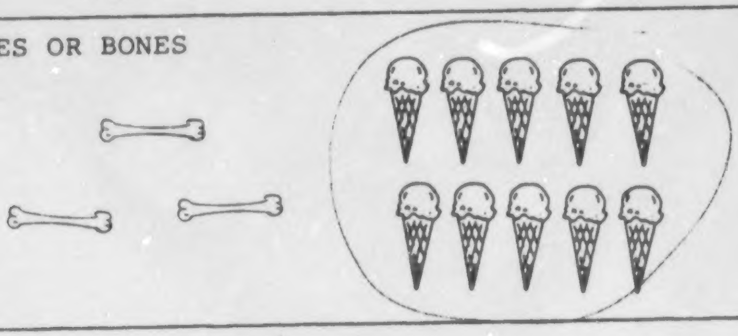
$4 - 3 = \boxed{1}$

STARS OR CARS



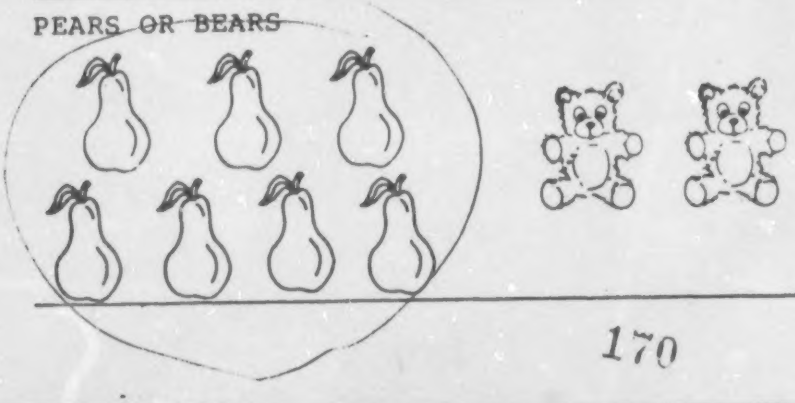
$8 - 6 = \boxed{2}$

CONES OR BONES



$10 - 3 = \boxed{7}$

PEARS OR BEARS



$7 - 2 = \boxed{5}$

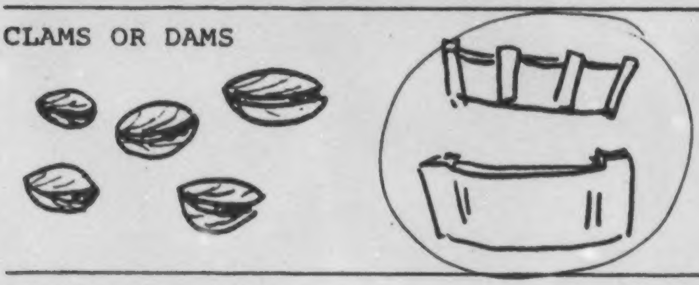
52D pt2

name ______________________

Which has fewer? Circle the smaller group.

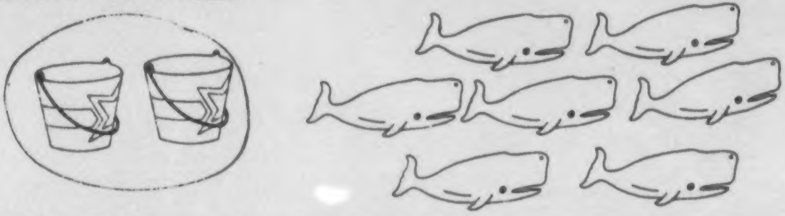
How many fewer? Write a sentence with a ☐. Then solve it.

CLAMS OR DAMS



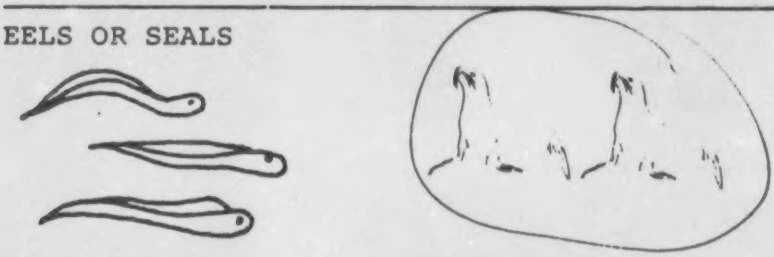
$5-2=\boxed{3}$

WHALES OR PAILS



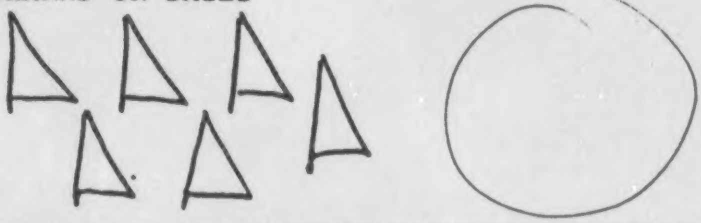
$7-2=\boxed{5}$

EELS OR SEALS



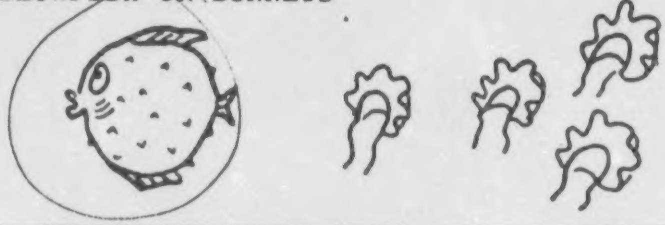
$3-2=\boxed{1}$

SHARKS OR SAILS



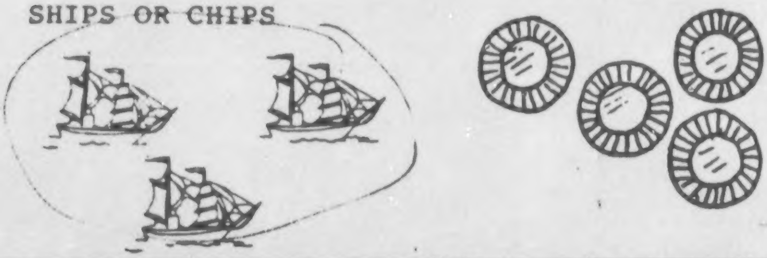
$6-0=\boxed{6}$

BLOWFISH OR BONNETS



$4-1=\boxed{3}$

SHIPS OR CHIPS



$4-3=\boxed{1}$

52Dpt2

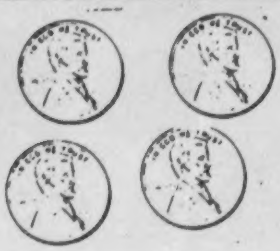
name

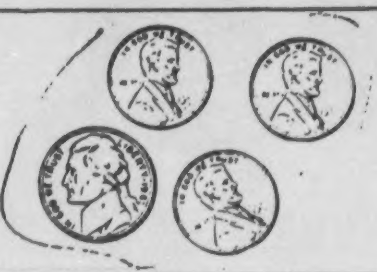
168

9

What is the difference? Write a sentence with a ☐.
Then solve the sentences.

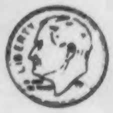
A

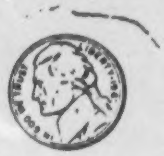




$8-4=\boxed{4\text{¢}}$

B





$10-5=\boxed{5\text{¢}}$

C

3¢ 6¢ $6-3=\boxed{3\text{¢}}$

D

5¢ 2¢ $5-2=\boxed{3\text{¢}}$

E

7¢ 1¢ $7-1=\boxed{6\text{¢}}$

F

0¢ 4¢ $4-0=\boxed{4\text{¢}}$

G

4¢ 2¢ $4-2=\boxed{2\text{¢}}$

S2D pt 2

name

RECORD SHEET

10

station letter **sentence**

S2E pt 1

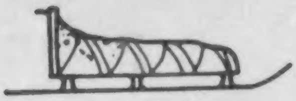
170 _ _'_ _

name ______________________________

DIFFERENCES

Length

USE THIS CHART:



sled: 6 ft

fish: 2 ft

boat: 4 ft

spear: 7 ft

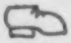
What is the difference in length for each pair? Write a sentence. Then solve it.

sled boat $6-4=\boxed{2}$	fish spear $7-2=\boxed{5}$
boat fish $4-2=\boxed{2}$	spear sled $7-6=\boxed{1}$
sled fish $6-2=\boxed{4}$	boat spear $7-4=\boxed{3}$

Weight

USE THIS CHART:

hat: 5



shoe: 9

star: 1

ball: 3

52E pt 2

What is the difference in weight for each pair? Write a sentence. Then solve it.

hat shoe $9-5=\boxed{4}$	hat star $5-1=\boxed{4}$
hat ball $5-3=\boxed{2}$	shoe star $9-1=\boxed{8}$
shoe ball $9-3=\boxed{6}$	star ball $3-1=\boxed{2}$

name

Sally wrote these sentences about hats in boxes. Solve them for her.

$6-0=\boxed{6}$ $6-3=\boxed{3}$ $5+1=\boxed{6}$

$2+2=\boxed{4}$ $2+0=\boxed{2}$ $4-3=\boxed{1}$

$3-1=\boxed{2}$ $2-1=\boxed{1}$ $6-4=\boxed{2}$

$4+1=\boxed{5}$ $5-1=\boxed{4}$ $2-2=\boxed{0}$

$3+3=\boxed{6}$ $3-0=\boxed{3}$ $3+1=\boxed{4}$

$0+0=\boxed{0}$ $1-1=\boxed{0}$ $5-4=\boxed{1}$

$4-1=\boxed{3}$ $4+2=\boxed{6}$ $3+2=\boxed{5}$

52F pt 1

13

name

Solve these sentences.

$2+4=\boxed{6}$ $1+3=\boxed{4}$ $2+1=\boxed{3}$

$0+1=\boxed{1}$ $5-3=\boxed{2}$ $6-1=\boxed{5}$

$4-0=\boxed{4}$ $1+5=\boxed{6}$ $4-2=\boxed{2}$

$2+3=\boxed{5}$ $5+0=\boxed{5}$ $6-5=\boxed{1}$

$6-6=\boxed{0}$ $3-2=\boxed{1}$ $1+4=\boxed{5}$

$1+1=\boxed{2}$ $1+2=\boxed{3}$ $2-0=\boxed{2}$

$5-2=\boxed{3}$ $6-2=\boxed{4}$ $4-4=\boxed{0}$

52Fpt 1

name

Solve these sentences.

$8-3=\boxed{5}$ Blue

$1+8=\boxed{9}$

$5+1=\boxed{6}$

$6+2=\boxed{8}$

$6+6=\boxed{12}$

$0+10=\boxed{10}$

$9+3=\boxed{12}$

$3+4=\boxed{7}$

$10+10=\boxed{20}$

$7-6=\boxed{1}$ White

$8-4=\boxed{4}$ Green

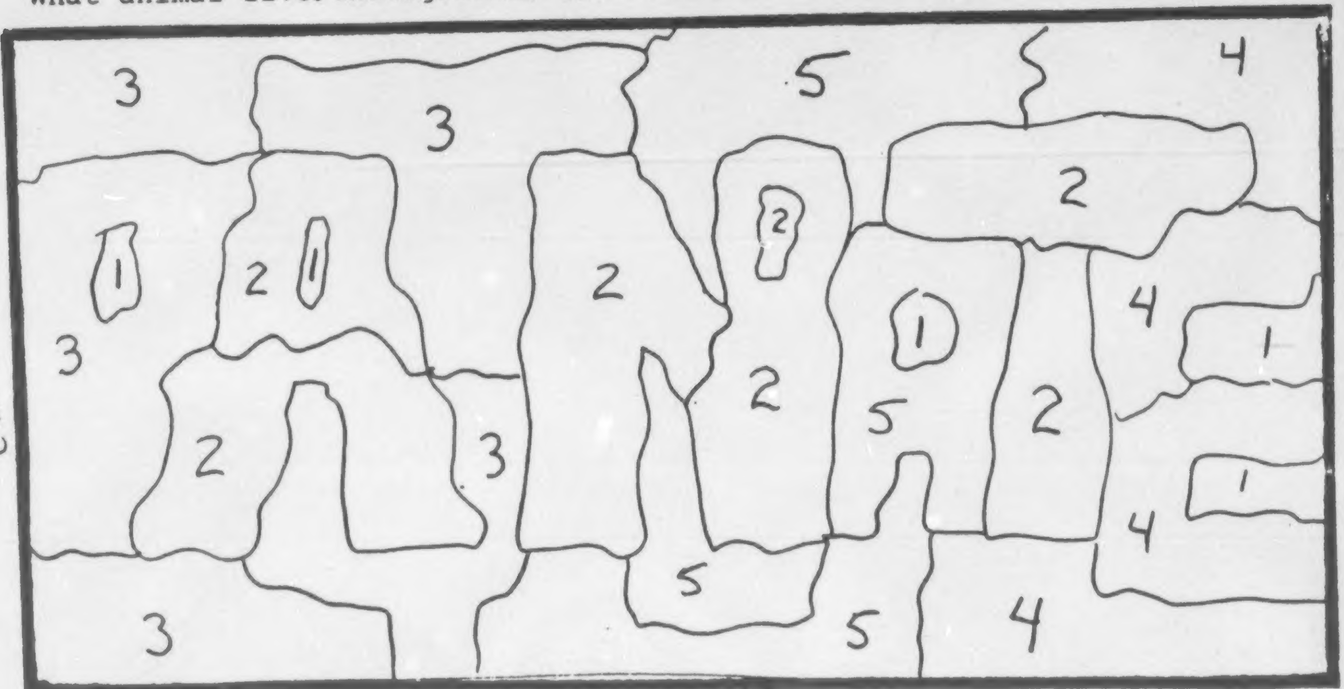
$9-3=\boxed{6}$

$6-4=\boxed{2}$ Red

$7-5=\boxed{2}$

$3-0=\boxed{3}$ Yellow

What animal lives underground, can climb trees, and has a queen?


3
3
5
4
2
1
2
1
2
2
3
1
4
1
3
2
3
2
5
2
1
5
4
3
5
5
4

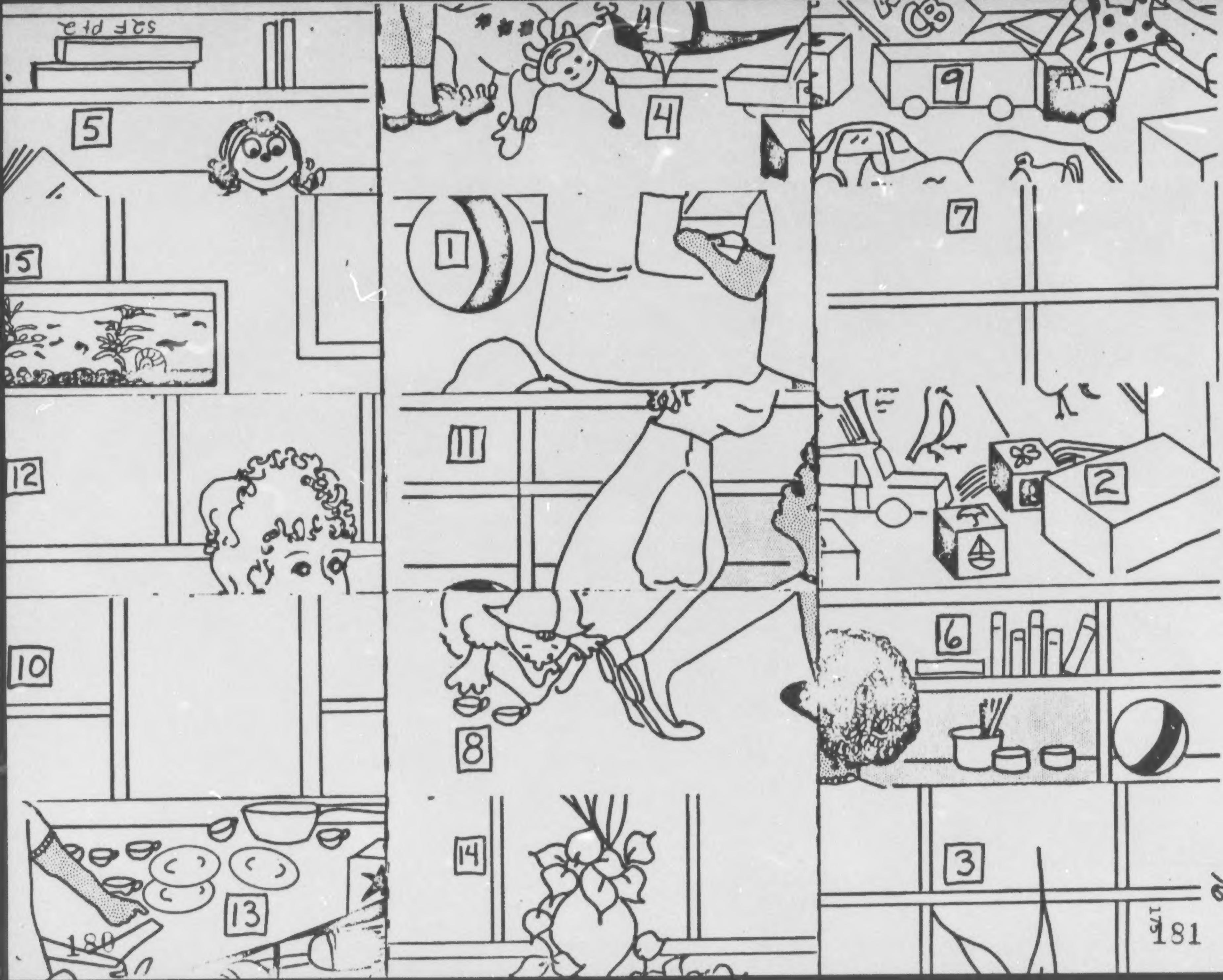
Saf pt 2

15

$5+2=\boxed{7}$	$7+3=\boxed{10}$	$6-3=\boxed{3}$
$8+4=\boxed{12}$	$16-1=\boxed{15}$	$7+7=\boxed{14}$
$5+6=\boxed{11}$	$8-2=\boxed{6}$	$2+3=\boxed{5}$
$4-3=\boxed{1}$	$6+7=\boxed{13}$	$10-1=\boxed{9}$
$4+4=\boxed{8}$	$5-1=\boxed{4}$	$1+1=\boxed{2}$

174

S2F pt 2


5
4
9
15
1
7
12
11
2
10
8
6
14
3
13

name____

EXAMPLE: If $1 + 2 = \boxed{3}$, what about $2 + 1 = \boxed{3}$?

If $2 + 3 = \boxed{5}$, then $3 + 2 = \boxed{5}$.

Draw lines to match the sentences that will have the same number in the ☐. Then solve to see if you were right.

$6+2= \boxed{8}$ $2+4= \boxed{6}$

$3+4= \boxed{7}$ $3+2= \boxed{5}$

$4+0= \boxed{4}$ $2+6= \boxed{8}$

$2+3= \boxed{5}$ $1+2= \boxed{3}$

$4+2= \boxed{6}$ $4+3= \boxed{7}$

$0+1= \boxed{1}$ $1+0= \boxed{1}$

$2+1= \boxed{3}$ $0+4= \boxed{4}$

526 pt1

name______________________________

Solve these pairs of sentences.

$1+5=\boxed{6}$

$5+1=\boxed{6}$

$6+4=\boxed{10}$

$4+6=\boxed{10}$

$0+8=\boxed{8}$

$8+0=\boxed{8}$

$3+5=\boxed{8}$

$5+3=\boxed{8}$

$1+3=\boxed{4}$

$3+1=\boxed{4}$

$2+0=\boxed{2}$

$0+2=\boxed{2}$

$7+1=\boxed{8}$

$1+7=\boxed{8}$

$2+5=\boxed{7}$

$5+2=\boxed{7}$

$3+7=\boxed{10}$

$7+3=\boxed{10}$

$0+3=\boxed{3}$

$3+0=\boxed{3}$

$4+1=\boxed{5}$

$1+4=\boxed{5}$

$4+5=\boxed{9}$

$5+4=\boxed{9}$

$9+1=\boxed{10}$

$1+9=\boxed{10}$

$0+10=\boxed{10}$

$10+10=\boxed{20}$

$3+4=\boxed{7}$

$4+3=\boxed{7}$

526 pt1

19

name ____________________

Solve the sentences in each FAMILY. Why do you think they are called Families?

A

$2+3=\boxed{5}$

$5-2=\boxed{3}$

$5-3=\boxed{2}$

$3+2=\boxed{5}$

B

$6-2=\boxed{4}$

$2+4=\boxed{6}$

$4+2=\boxed{6}$

$6-4=\boxed{2}$

C

$4-2=\boxed{2}$

$2+2=\boxed{4}$

D

$3+3=\boxed{6}$

$6-3=\boxed{3}$

E

$1+3=\boxed{4}$

$3+1=\boxed{4}$

$4-1=\boxed{3}$

$4-3=\boxed{1}$

F

$5+5=\boxed{10}$

$10-5=\boxed{5}$

H

$1+1=\boxed{2}$

$2-1=\boxed{1}$

G

$3-1=\boxed{2}$

$3-2=\boxed{1}$

$1+2=\boxed{3}$

$2+1=\boxed{3}$

526 pt 2

I

$3+5=\boxed{8}$

$5+3=\boxed{8}$

$8-3=\boxed{5}$

$8-5=\boxed{3}$

J

$0+0=\boxed{0}$

$0-0=\boxed{0}$

name ______________________

Write the other 3 sentences in each Family and solve them.

$5-1=\boxed{4}$

$5-4=\boxed{1}$

$1+4=\boxed{5}$

$4+1=\boxed{5}$

$4+3=\boxed{7}$

$3+4=\boxed{7}$

$7-3=\boxed{4}$

$7-4=\boxed{3}$

$8-5=\boxed{3}$

$8-3=\boxed{5}$

$5+3=\boxed{8}$

$3+5=\boxed{8}$

$3+6=\boxed{9}$

$6+3=\boxed{9}$

$9-3=\boxed{6}$

$9-6=\boxed{3}$

$1+6=\boxed{7}$

$6+1=\boxed{7}$

$7-6=\boxed{1}$

$7-1=\boxed{6}$

$7-2=\boxed{5}$

$7-5=\boxed{2}$

$2+5=\boxed{7}$

$5+2=\boxed{7}$

$3+1=\boxed{4}$

$1+3=\boxed{4}$

$4-1=\boxed{3}$

$4-3=\boxed{1}$

$6-2=\boxed{4}$

$6-4=\boxed{2}$

$2+4=\boxed{6}$

$4+2=\boxed{6}$

$8-6=\boxed{2}$

$8-2=\boxed{6}$

$6+2=\boxed{8}$

$2+6=\boxed{8}$

526 pt2

name____________________

Cross out the false answers and fix them.

$5-3=\boxed{\cancel{8}}$ 2

$4+2=\boxed{6}$

$10-5=\boxed{\cancel{4}}$ 5

$8-0=\boxed{\cancel{0}}$ 8

$7-6=\boxed{1}$

$10+0=\boxed{\cancel{0}}$ 10

$6-5=\boxed{1}$

$8-1=\boxed{\cancel{9}}$ 7

$0+4=\boxed{4}$

$3+7=\boxed{10}$

$3+1=\boxed{\cancel{2}}$ 4

$9-6=\boxed{3}$

$4+4=\boxed{\cancel{4}}$ 8

$0+5=\boxed{5}$

$7-2=\boxed{\cancel{6}}$ 5

$9-2=\boxed{\cancel{1}}$ 7

$3+4=\boxed{\cancel{9}}$ 7

$2+1=\boxed{3}$

$5-4=\boxed{\cancel{9}}$ 1

H25

$10-2=\boxed{\cancel{12}}$ 8

22

181

name

CROSS OUT THE FALSE ANSWERS AND FIX THEM.

$1+4=\boxed{5}$

$2+0=\boxed{2}$

$9+1=\boxed{\cancel{9}}$ 10

$8-3=\boxed{\cancel{4}}$ 5

$1+3=\boxed{4}$

$2+2=\boxed{4}$

$5-5=\boxed{\cancel{10}}$ 0

$6-0=\boxed{\cancel{5}}$ 6

$7-5=\boxed{2}$

$1+5=\boxed{\cancel{7}}$ 6

$6+6=\boxed{12}$

$4-3=\boxed{\cancel{7}}$ 1

$0+5=\boxed{5}$

$1+2=\boxed{\cancel{4}}$ 3

$3+3=\boxed{6}$

$10-7=\boxed{3}$

$4-2=\boxed{\cancel{1}}$ 2

$6-4=\boxed{2}$

$3-2=\boxed{\cancel{5}}$ 1

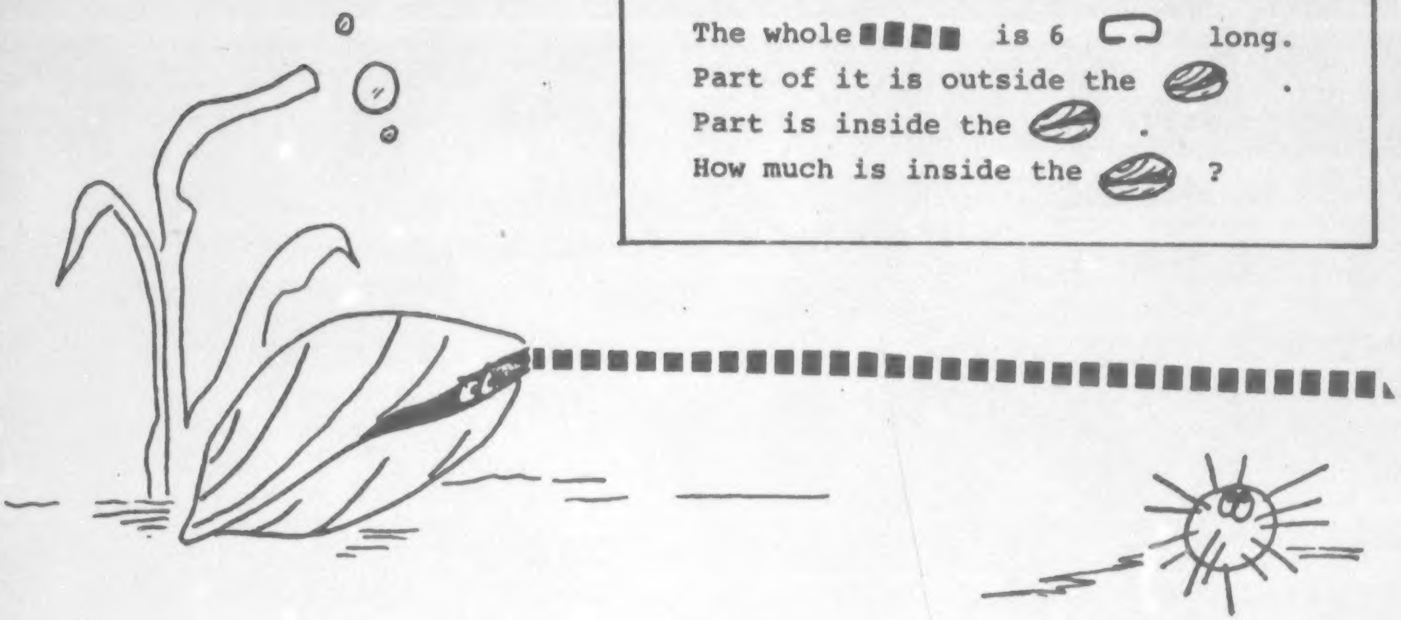
$9-5=\boxed{\cancel{3}}$ 4

H25

a Write a sentence with a ☐. Then solve it. Card S2Ca

Story:

The whole ▮▮▮▮ is 6 ⊂⊃ long.
Part of it is outside the ⬬ .
Part is inside the ⬬ .
How much is inside the ⬬ ?



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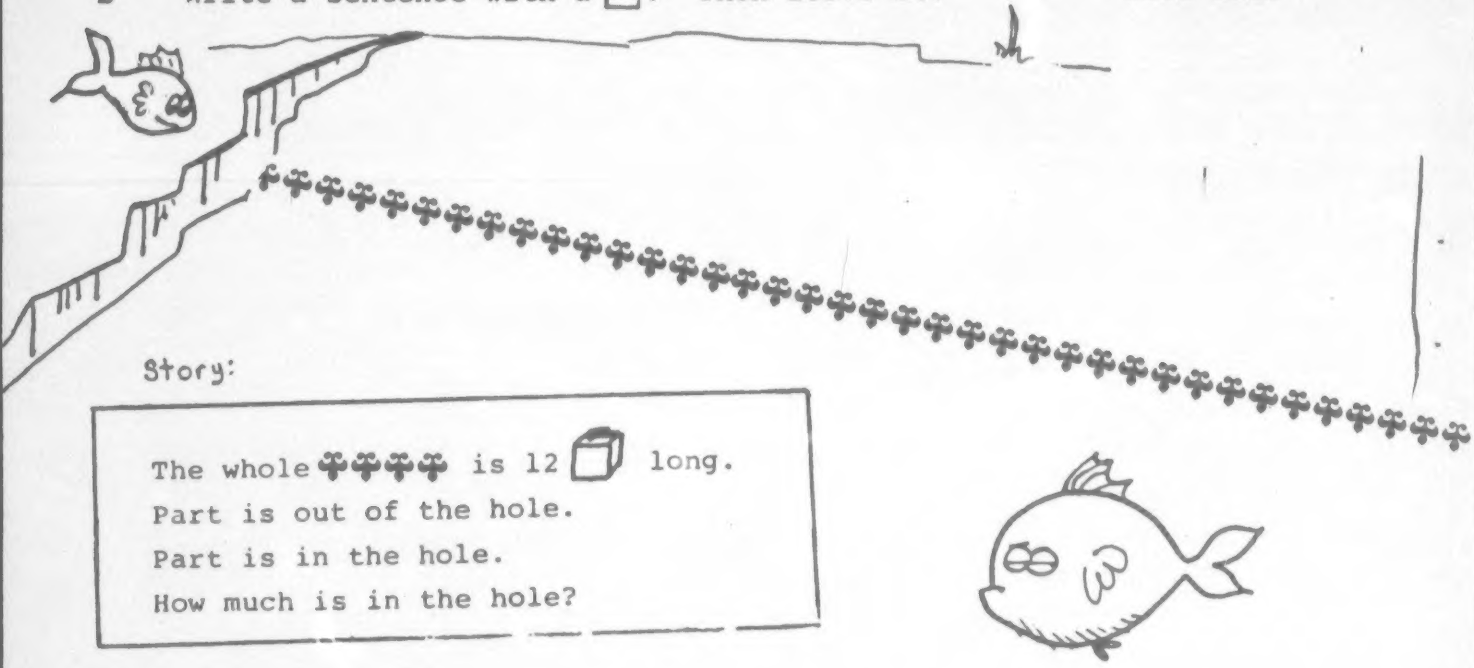
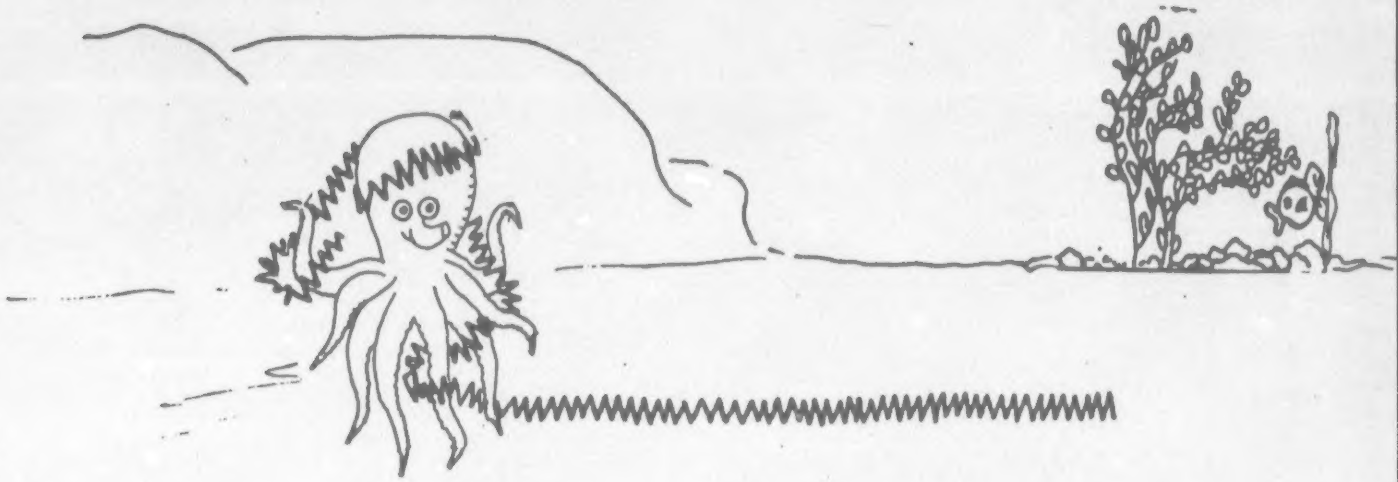
b Write a sentence with a ☐. Then solve it. Card S2Cb



Story:

The whole ♣♣♣♣ is 12 ⬚ long.
Part is out of the hole.
Part is in the hole.
How much is in the hole?

c Write a sentence with a ☐. Then solve it. Card S2Cc



Story:

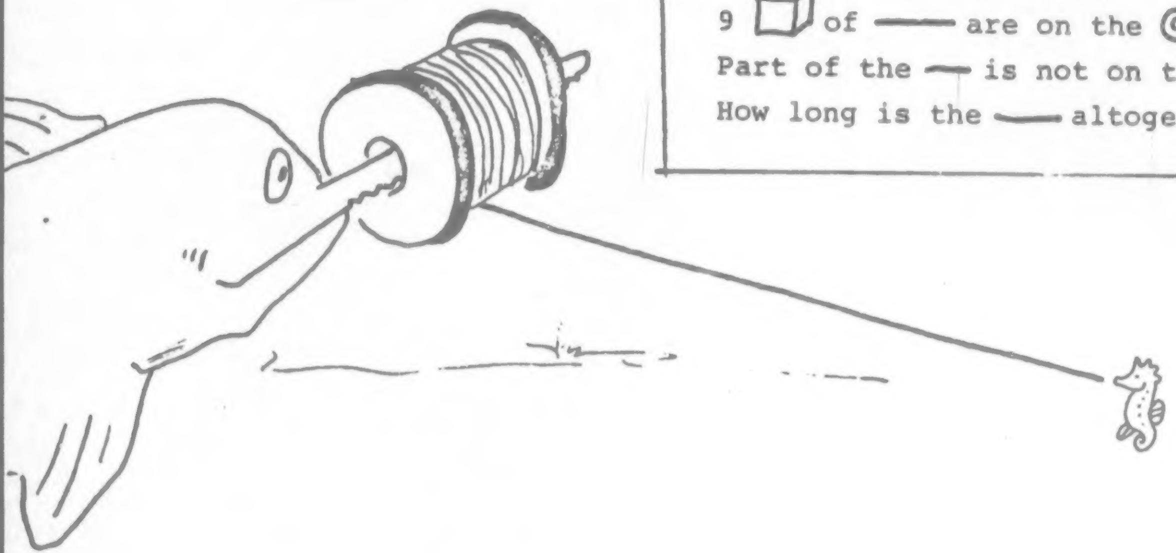
6 ⊂⊃ of 〰 are on the 🐙.
Part of the is not on the 🐙.
How long is the whole 〰?

---

d Write a sentence with a ☐. Then solve it. Card S2Cd

Story:

9 ☐ of — are on the ◎.
Part of the — is not on the ◎.
How long is the — altogether?



e Write a sentence with a ☐. Then solve it. Card S2Ce

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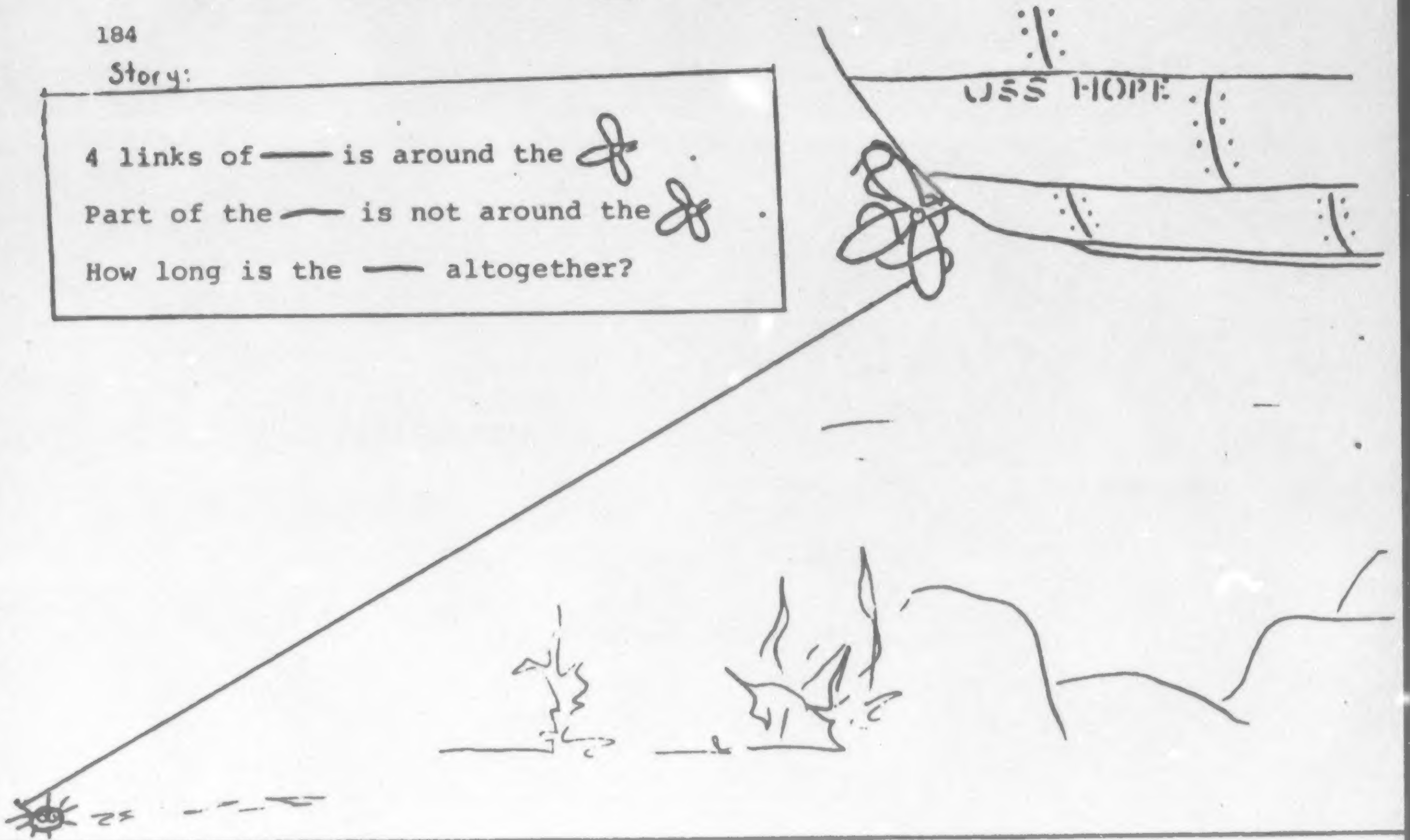
Story:

4 links of —— is around the ✢ .

Part of the —— is not around the ✢ .

How long is the —— altogether?



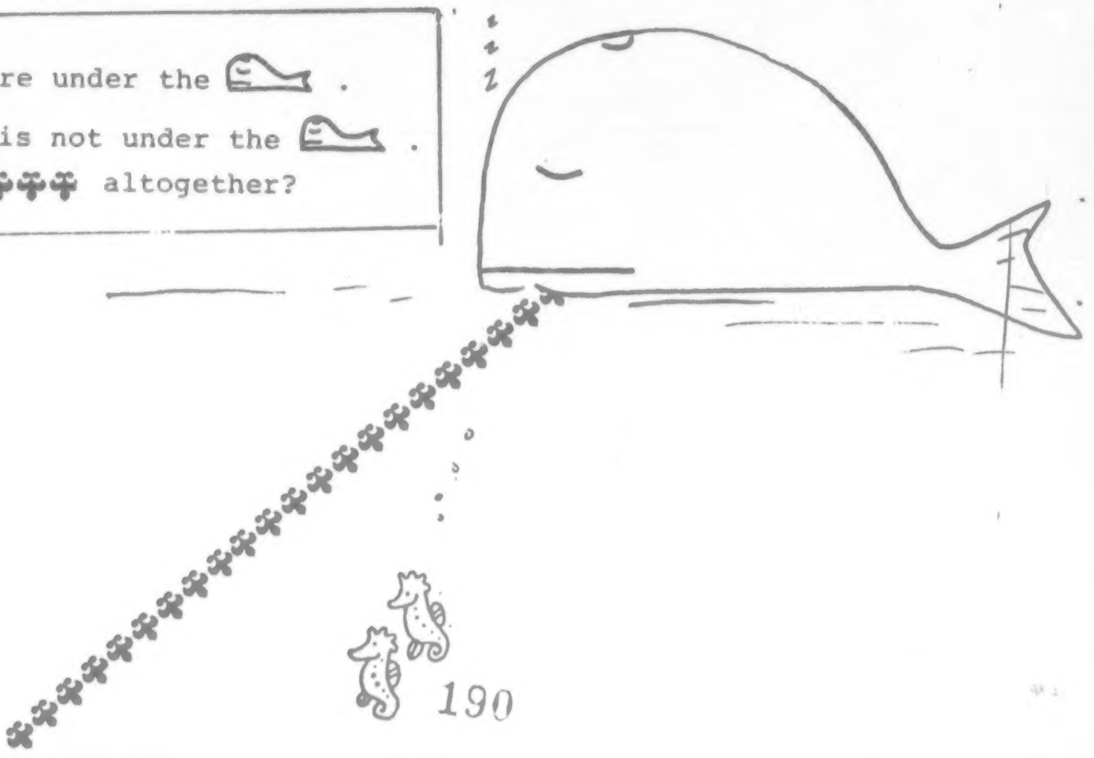
f Write a sentence with a ☐. Then solve it. Card S2Cf

Story:

3 cubes of ✤✤ are under the 🐋 .

Part of the ✤✤ is not under the 🐋 .

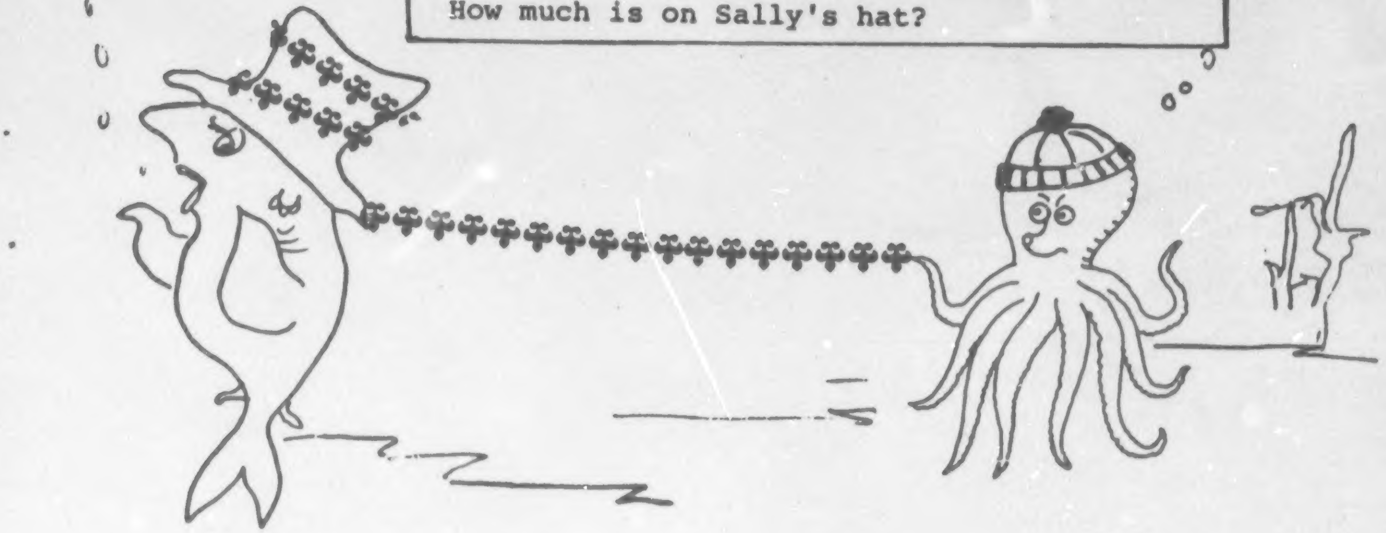
How long is the ✤✤✤ altogether?



g Write a sentence with a ☐. Then solve it. Card S2Cg

Story:

The whole piece of ♣♣♣ is 5 links long.
Part of it is on Sally's hat.
Part of it is not on Sally's hat.
How much is on Sally's hat?



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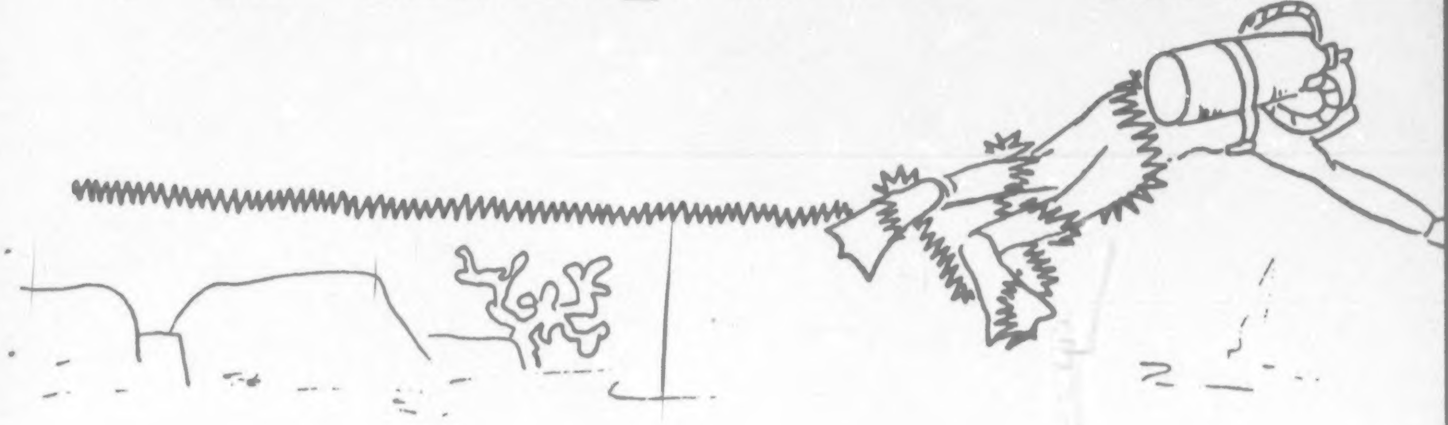
h Write a sentence with a ☐. Then solve it. Card S2Ch



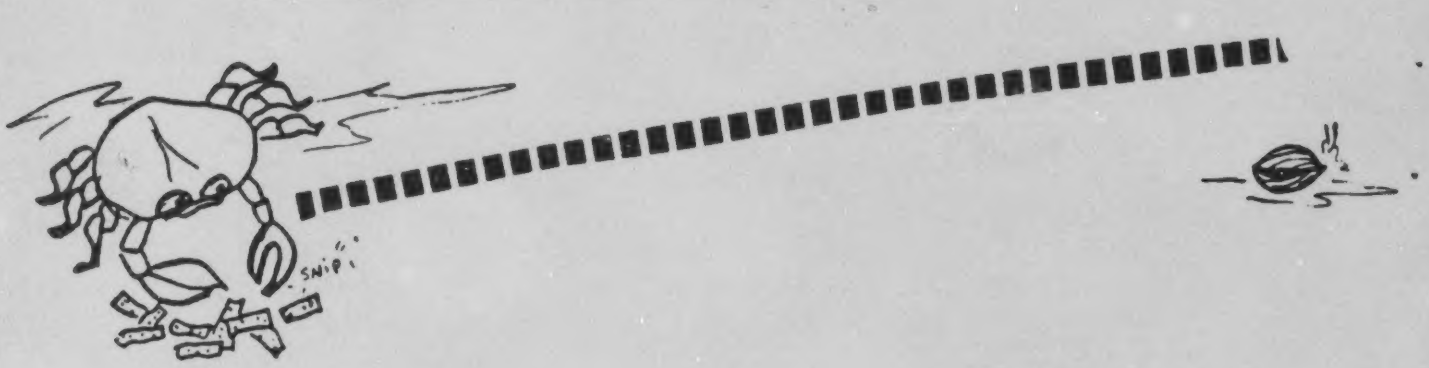
Story:

The whole ∧∧∧∧ is 10 cubes long.
Part is around the man.
Part is not around the man.
How much is around the man?

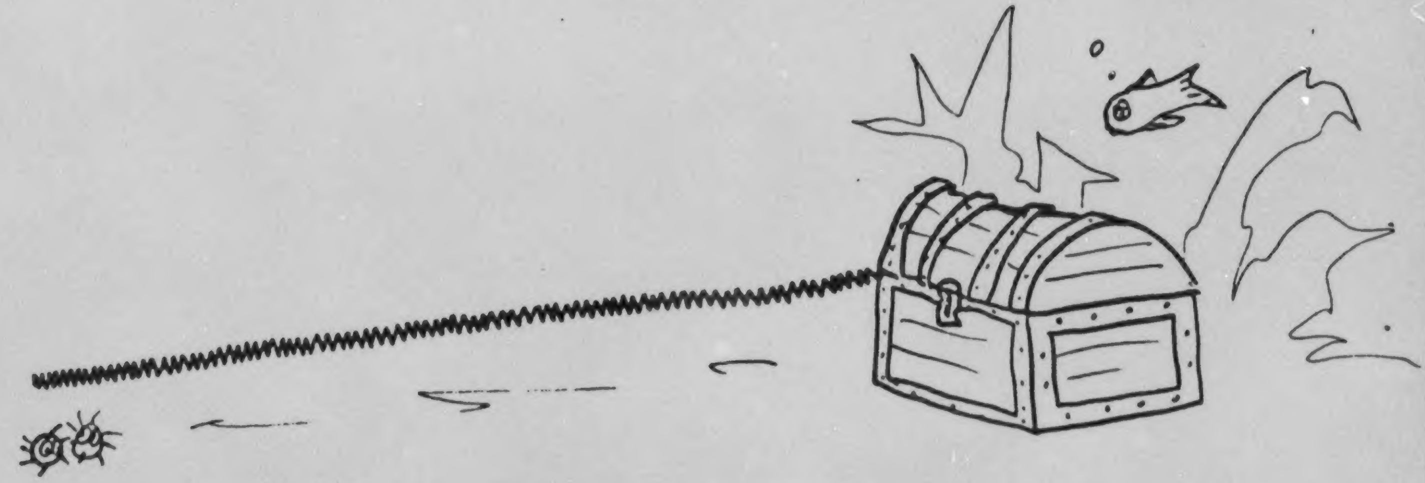
i   Write a sentence with a □. Then solve it.   Card S2Ci

Story:

The ■■■■ was 11 cubes long.
Part of it is not cut up.
Part of it is cut up.
How much is cut up?



j   Write a sentence with a □. Then solve it.   Card S2Cj



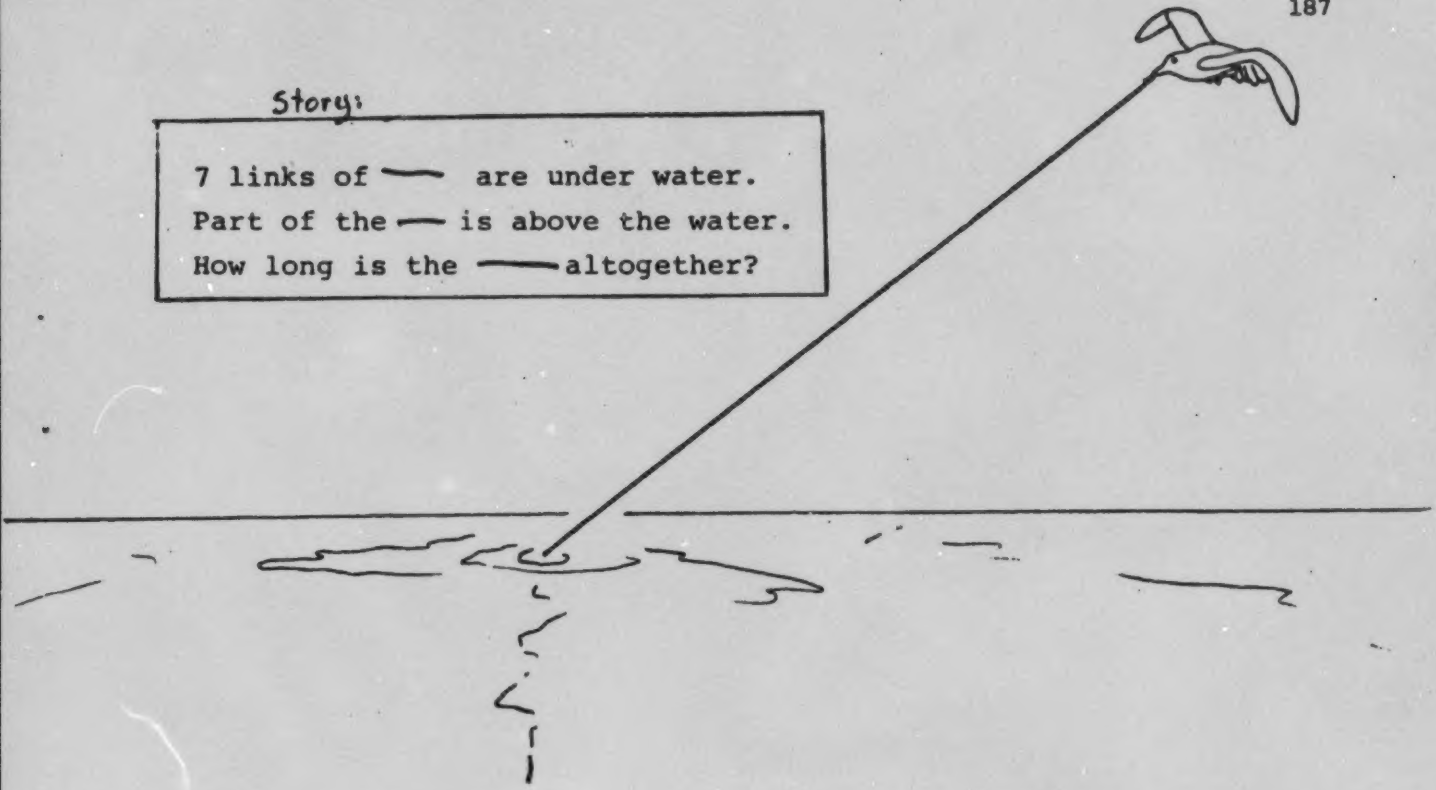
Story:

The whole 〰〰 is 9 links long.
Part of it is in the .
Part of it is out of the .
How much is in the ?

k Write a sentence with a ☐. Then solve it. Card S2Ck

Story:

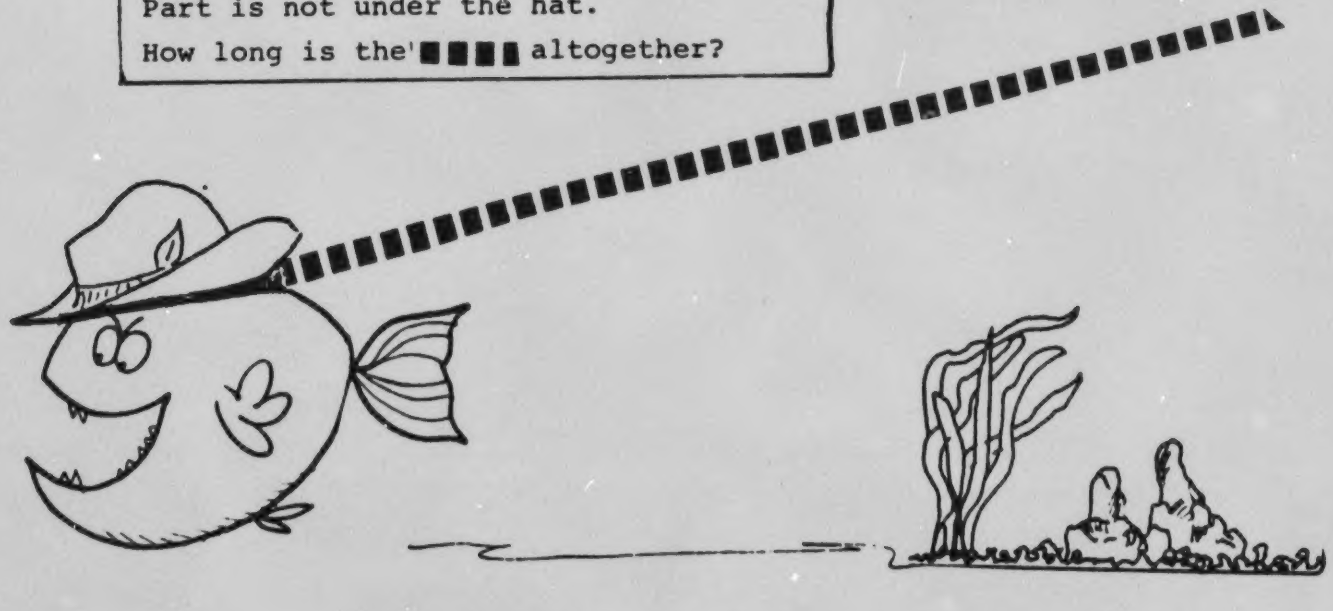
7 links of —— are under water.
Part of the —— is above the water.
How long is the —— altogether?



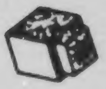
1 Write a sentence with a ☐. Then solve it. Card S2C1

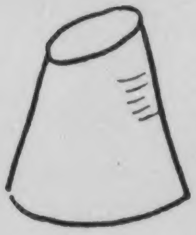
Story:

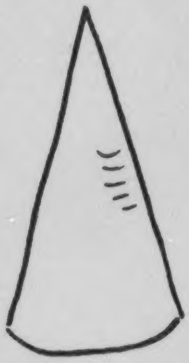
1 cube of ■■■| is under the hat.
Part is not under the hat.
How long is the ■■■■ altogether?



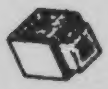
Card S2Ea

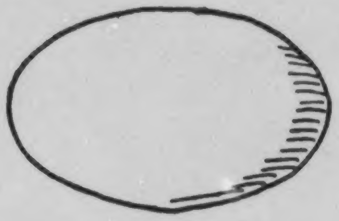
Use  to weigh.
What is the difference in weight?
Write a sentence. Solve it.

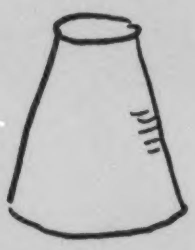




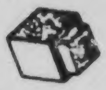
Card S2Eb

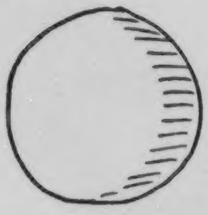
Use  to weigh.
What is the difference in weight?
Write a sentence. Solve it.

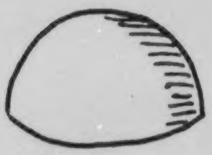




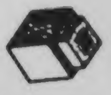
Card S2Ec

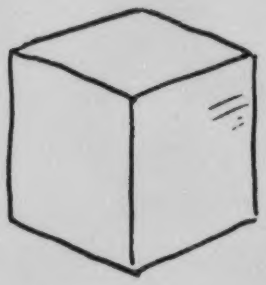
Use  to weigh.
What is the difference in weight?
Write a sentence. Solve it.

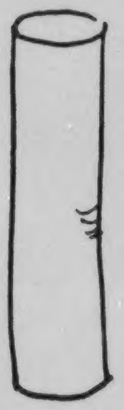




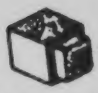
Card S2Ed

Use  to weigh.
What is the difference in weight?
Write a sentence. Solve it.



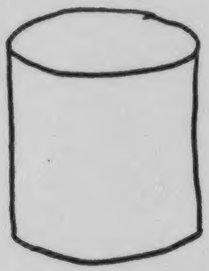


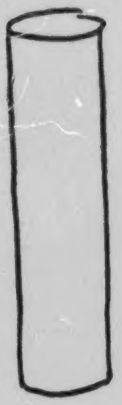
Card S2Ee

Use  to find how tall.

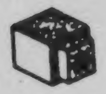
What is the difference in height?

Write a sentence. Solve it.



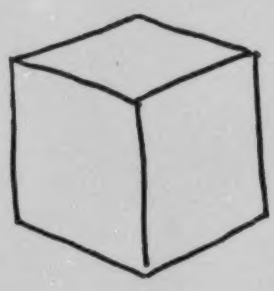


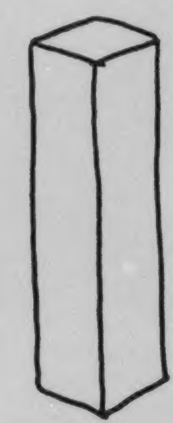
Card S2Ef

Use  to find how tall.

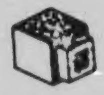
What is the difference in height?

Write a sentence. Solve it.



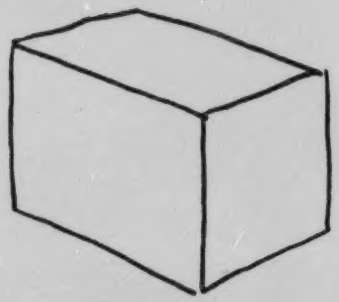


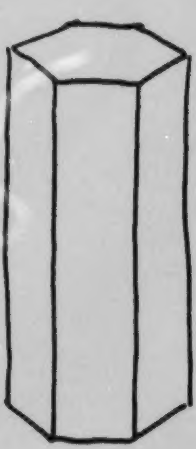
Card S2Eg

Use  to find how tall.

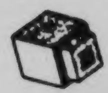
What is the difference in height?

Write a sentence. Solve it.



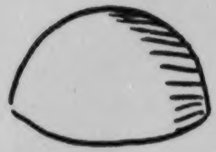


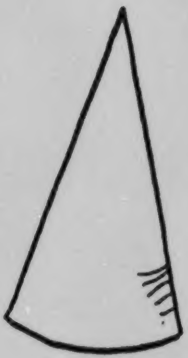
Card S2Eh

Use  to find how tall.

What is the difference in height?

Write a sentence. Solve it.



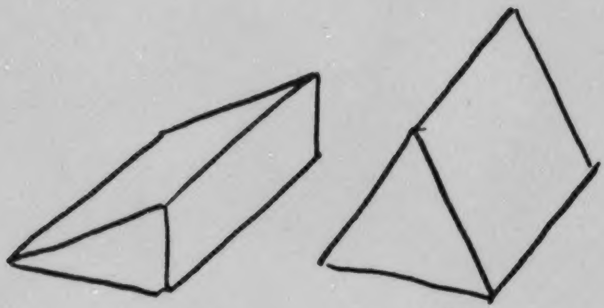


Card S2Ei

Use to weigh.

What is the difference in weight?

Write a sentence. Solve it.

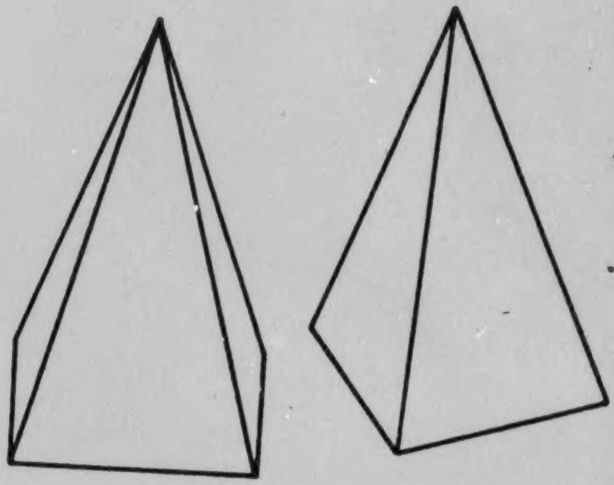


Card S2Ej

Use to weigh.

What is the difference in weight?

Write a sentence. Solve it.

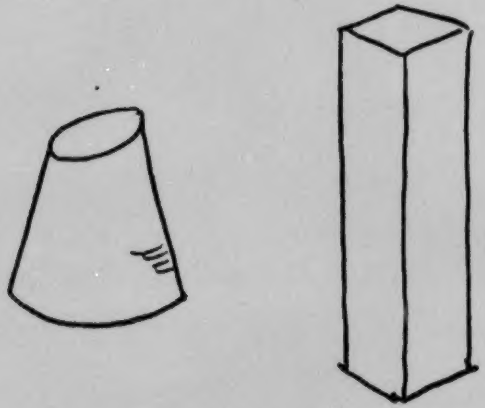


Card S2Ek

Use to find how tall.

What is the difference in height?

Write a sentence. Solve it.

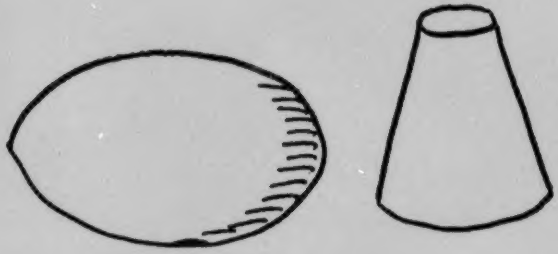


Card S2El

Use to find how tall.

What is the difference in height?

Write a sentence. Solve it.



APPENDIX C

TOPIC S-3: SOLVING NUMBER SENTENCES 0-10

Fall 1978

TOPIC S3: SOLVING NUMBER SENTENCES 0-10

OBJECTIVES

Regular

1. Given an open sentence of the form $a + b = \square$ or $\begin{array}{r} a \\ +\,b \\ \hline \end{array}$ involving the numbers 0-10, solves it. (solves $a + b = \square$ sentence 0-10)
2. Given an open sentence of the form $a - b = \square$ or $\begin{array}{r} a \\ -\,b \\ \hline \end{array}$ involving the numbers 0-10, solves it. (solves $a - b = \square$ sentence 0-10)

Preparatory

3. Given an open problem situation involving the numbers 0-20 that is solvable by using either addition or subtraction, writes a sentence that represents that situation. (writes open + or - sentence 0-20)

OVERVIEW

This is the third in the series of six topics designed to help children acquire the problem solving skills necessary to solve addition and subtraction problems involving the numbers 0-20. In the first two, the problem situations presented were intended to be straightforward and relatively easy for the children. The reason was that we wanted the children to learn the skill of symbolically representing the situation with an addition or subtraction open sentence as well as become familiar with the "+" and "-" symbols. Difficult or unfamiliar problem situations could interfere with the learning of those skills. Thus, we chose the simple joining, separating, difference, and part-part-whole situations that the children had encountered in earlier DMP topics in Level One.

In this topic we are trying to anticipate the somewhat more difficult and unfamiliar situations that the children will meet in later topics. Towards this end we are introducing a device here that will hopefully enable the children to analyze any addition and subtraction problem situation and then decide directly whether to add or subtract the numbers involved in that problem situation. This device is the part-part-whole chart: It is our feeling that with proper guidance and instruction the children can be made to see that addition and subtraction problems can be thought of in the context of part-part-whole and that the analysis hinges around deciding whether the two numbers in the problem represent the two parts or the whole and one of the parts. The key to deciding whether to add or subtract are these relationships:

WHOLE	
Part	Part

1. Part + Part = WHOLE
2. WHOLE - Part = Part

These relationships were suggested in Topic S-2 and hopefully verbalized to the children. Here the relationships are made much more explicit and direct by means of actually writing them down and asking the children to fill in the chart given above. Contiually stress and verbalize these relationships to the children.

In dealing with the use of chart again we will restrict the problem situations to those that are straightforward and relatively easy for the children. The first type of situation is the part-part-whole situation itself; that is followed by joining and separating. The difference situation and others not yet presented in earlier topics will be covered in succeeding topics in this six-topic sequence.

This topic also introduces the vertical forms for addition and subtraction. For convenience, it is called the "up and down." The children should realize that $2 + 3 = \square$ is the same as $\begin{array}{r} 2 \\ \underline{+\ 3} \end{array}$ and they should be able to write either or both forms from a given situation.

Mastery of the basic addition and subtraction facts 0-10 is expected by the end of this topic. In addition to mastery, the children should begin to realize that addition is commutative, but subtraction is not, and that addition and subtraction are related. That is, that an addition problem and its related subtraction problems have the same whole and parts.

For example:

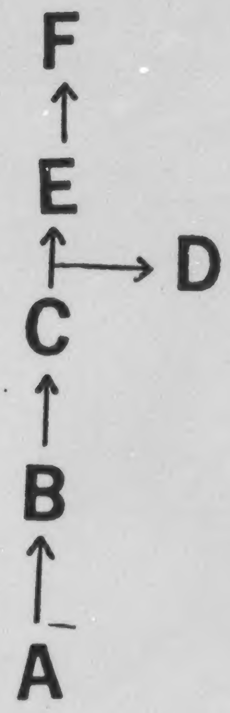
$3 + 6 = 9$

$9 - 6 = 3$

$9 - 3 = 6$

9	
3	6

If at the end of the topic, you have identified some children who are not at the desired level of mastery on the 0-10 basic facts, then a program of carefully sequenced and spaced drill is suggested. Such drill and review is also appropriate to keep children up to a mastery level that they may have already attained.


F
E
D
C
B
A

ACTIVITY S3 A

In this activity the children are introduced to the terms addition and subtraction, and to the general, symbolic part-part-whole model for analyzing subtraction and addition situations.

Objectives

Regular

1 solves $a + b = \square$ sentence 0-10

2 solves $a - b = \square$ sentence 0-10

Preparatory

3 writes open + or - sentence 0-20

Organization

large group and individual

Vocabulary

subtraction

addition

add

subtract

Materials

Student Booklet pages 2 and 3 (Part 1)

Student Booklet page 4 (Part 2)

flannel board (Parts 1 and 2)

objects (Parts 1 and 2)

Preparation

Get out flannel board or objects (Parts 1 and 2).

Prepare tag board (optional)

<table>
<tr><td colspan="2">WHOLE</td></tr>
<tr><td>Part</td><td>Part</td></tr>
</table>

Add: Part + Part = $\boxed{\text{WHOLE}}$

Subtract: WHOLE - Part = $\boxed{\text{Part}}$ (Part 1)

Teaching Suggestions

Part 1 The first half of this part introduces the terms addition, adding, subtraction, and subtracting. The second half introduces a chart and method for solving addition and subtraction situations that uses part-part-whole as its basis.

Begin by writing the following on the board:

+ add (addition)

- subtract (subtraction)

Explain to the children that "adding on" or "joining" is called adding or addition; and that "taking away" or "separating" is called subtracting or subtraction. Have the children read the words with you.

Next discuss the following stories. Use the flannel board, objects or pictures to represent each story. Let the children tell you what sentence to write and how to solve each.

1. There are 8 links in a container. 3 are red, the rest are blue. How many links are blue? ($8 - 3 = \boxed{5}$)

2. Six red flags are put with seven yellow flags. How many flags are there altogether? ($6 + 7 = \boxed{13}$)

3. There are 14 people on a bus. Five are men; the rest are women. How many women are there? (14 - 5 = $\boxed{9}$)

After the children have done these, remind them that after reading a story they have to decide what kind of a sentence to write, addition or subtraction. Explain that there is a way to think about any story that will help them decide.

Write the following on tag board or on the board:

WHOLE	
Part	Part

Add: Part + Part = $\boxed{\text{WHOLE}}$

Subtract: WHOLE - Part = $\boxed{\text{Part}}$

Explain that for each addition or subtraction story there are three things: the whole and the two parts that make up the whole. Go back to Example 1. Show this with objects: 8 objects, 3 red and 5 blue.

0 0 0 0 0 0 0 0	
0 0 0	0 0 0 0 0

The whole is what? (8 objects)

One part is what? (3 red objects)

The other part is what? (5 blue objects)

Explain that in stories where they need to add, the story tells what the two parts are and asks the children to find the whole.

Ex: I have 5 flags and 6 bells. How many things do I have altogether?

In stories where they need to subtract, the story tells the size of the whole and the size of one part, then asks the children to find the other part.

Ex: I have 12 objects. 7 are green. The rest are yellow. How many are yellow?

Next do the following examples:

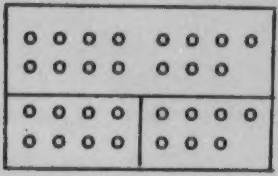
3. There are 8 red balls and 7 blue balls.

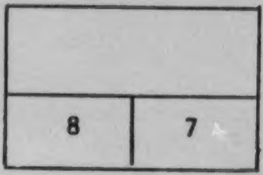
How many balls altogether?

Ask what the story tells. (the two parts) Draw and fill in the chart.

Ask what the story wants them to find. (the whole) This is what is missing in the chart.

Have the children represent with objects.





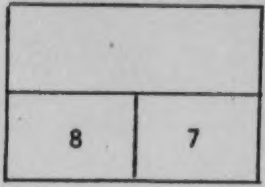
Ask what kind of story it is if they know the two parts.

(addition).

Write the sentence.

$8 + 7 = \square$ then solve it. Do not put the answer in the chart—only in the sentence.

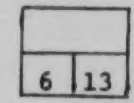
$8 + 7 = \boxed{15}$



Next have the children read the sentence with the answer.
Ask if it makes sense to them. If two parts are added to get the whole, then the whole is probably going to be greater than either of the parts. 15 is greater than 8 and 15 is greater than 7.

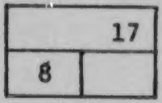
Do these example in the same way:

4. 6 boys meet 13 girls. How many children altogether?



$6 + 13 = \boxed{19}$ There are 19 children altogether.

5. 17 doughnuts are in a bag. 8 are sugared, the rest are frosted. How many are frosted?



$17 - 8 = \boxed{9}$

9 doughnuts are frosted

When you think the children understand the chart, let them do Student Booklet pages 2 and 3 individually. They should do the chart, write the sentence, and then solve. Remind them that only the information that the story gives goes in the chart, not the answer.

Part 2 In this part the use of the part-part-whole chart is extended to joining and separating situations.

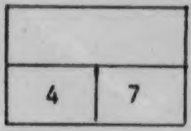
Begin by explaining to the children that the chart works for other stories too. Do the following examples. Use the children to represent.

1. 4 children are standing. 7 more stand. How many are standing now?

Ask what the story tells. (At first, 4 children are standing then 7 more stand.)

Ask if those are parts or wholes. (Parts--the part that was standing and the part that joined them. Together they make the whole number of children standing.)

Next draw the chart.

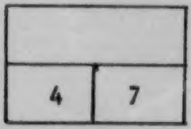


Write the sentence:

$p + p = W$

$4 + 7 = \boxed{}$

Then solve:

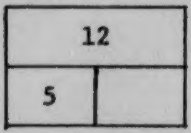


$4 + 7 = \boxed{11}$

There are 11 children standing now.

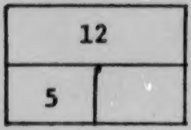
Do the following examples in the same way.

2. Twelve children are at the front of the room. 5 sit down. How many are left?



$W - P = P$

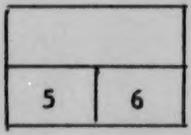
$12 - 5 = \square$



$12 - 5 = \boxed{7}$

seven children
are left.

3. There are 5 children. Six more children come. How many children altogether?



$5 + 6 = \boxed{11}$

There are 11
children altogether.

Do as many more examples as you think necessary, then let the children do the stories on Student Booklet page 4 independently.

ACTIVITY S3 B

In this activity the children are given a variety of addition and subtraction situations for which they write and solve sentences. Situations in which the word order is unfamiliar to the children are also introduced.

Objectives

Regular

① solves $a + b = \square$ sentence 0-10

② solves $a - b = \square$ sentence 0-10

Preparatory

3 writes open + or - sentence 0-20

Organization

individual (Parts 1 and 2)

Materials

Student Booklet page 5 (Part 1)

Student Booklet pages 6 to 8 (Part 2)

objects to solve with (Parts 1 and 2)

Preparation

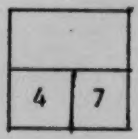
No special preparation required.

Teaching Suggestions

Part 1 In this part, the children are given situations in which the word order is different from that which they have previously used. They are encouraged to use the part-part-whole analysis and chart to help write the correct sentence.

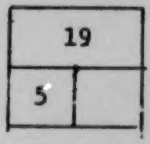
Do the following stories with the children.

1. Silly had 4 crayons. How many would he have altogether if Franny gave him 7 more crayons?



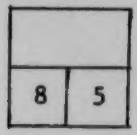
$4 + 7 = \boxed{11}$ crayons

2. Goofy used 5 tacks from a jar. There were 19 tacks in the jar to begin with. How many tacks were left?



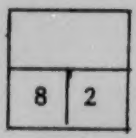
$19 - 5 = \boxed{14}$ tacks

3. How many birds are sitting on a roof if 8 birds joined 5 other birds?



$8 + 5 = \boxed{13}$ birds

4. Mr. D. Zine used 8 nails to build a wagon. Then he used 2 nails to hang pictures. How many nails did he use for both jobs?



$8 + 2 = \boxed{10}$ nails

5. Sally Shark started with 13 hats. She sold nine, but couldn't sell the others. How many couldn't she sell?

<table>
<tr><td colspan="2">13</td></tr>
<tr><td>9</td><td></td></tr>
</table>

$13 - 9 = \boxed{4}$ hats

After you have done a sufficient number of examples, let the children do Student Booklet page 5 on their own.

Part 2 In this part the children are given a variety of joining, separating and part-part-whole situations for which they write and solve sentences. Encourage them to use the chart to help them decide whether to write an addition or subtraction sentence.

<table>
<tr><td colspan="2">WHOLE</td></tr>
<tr><td>Part</td><td>Part</td></tr>
</table>

Student Booklet pages 6-8. These pages are similar to those the children have done before and should provide you with time to observe and help the children individually.

ACTIVITY S3 C

Vertical notation for addition and subtraction sentences is introduced in this activity.

Objectives

Regular

① solves a + b = ☐ sentence 0-10

② solves a - b = ☐ sentence 0-10

Preparatory

3 writes open + or - sentence 0-20

Organization

large group (Part 1)

individuals or pairs (Part 2)

Vocabulary

sum

difference

Materials

Student Booklet pages 9 to 11 (Part 1)

Student Booklet pages 12 and 13 (Part 2)

connecting cubes, links. or counting chips (Parts 1 and 2)

blank dice and labels, or construction paper for number cards (Part 2)

blank paper (Part 2)

Preparation

Part 2 Either have each child make a set of number cards 0 to 10 by folding a sheet of construction paper into twelfths or sixteenths or make a pair of dice for each child or pair of children labeling the two dice randomly with the numbers 0-10.

Teaching Suggestions

Part 1 Have the children gather around you at the chalkboard. Write an open sentence on the board, for example,

$$3 + 5 = \square.$$

Tell the children that to make it easier to solve the sentence people sometimes write them a "tall" way or the up and down form.

$\begin{array}{r} 3 \\ +\ 5 \\ \hline \end{array}$ (write it on the board)

Ask them what they think $\begin{array}{r} 3 \\ +\ 5 \\ \hline \end{array}$ means. Undoubtedly, someone will say "three plus five" or "three add on five equals something." Ask what they think the answer is. When someone volunteers the answer, write it down

$$\begin{array}{r} 3 \\ +\ 5 \\ \hline 8 \end{array}$$

and say that eight is called the sum of three and five. It now tells the children that when they add five to three, the sum is eight.

Write the eight in the box of the original open sentence as well. Have a child use cubes or other objects to validate the solutions.

Now write another open sentence, for example, $7 - 2 = \square$.

Then write $\begin{array}{r} 7 \\ -\ 2 \\ \hline \end{array}$ on the board, once again asking someone to tell what they think it says. Point out that the number to be taken away is written underneath the number it is taken away from. Ask what they think the number is. When someone volunteers the answer, write it down

$$\begin{array}{r} 7 \\ -\,2 \\ \hline 5 \end{array}$$

and say that five is called the difference between seven and two. This means that when you take away two from seven, the difference is five.

Write the five in the box of the original open sentence as well. Have a child validate the solution with objects.

Write on the board several of the types of open sentences used in your introductory demonstration. Have volunteers come up to the board, write the vertical notation, decide the sum or difference, record it ① ②, and validate it.

Then have the children do Student Booklet pages 9 to 13. On pages 9 and 10 the children are given the horizontal and write the vertical, then solve ① ②. On page 11 they write the horizonal from the vertical. Some children may translate $8 + 4 = \square$ as $\begin{array}{r} 4 \\ \underline{+\,8} \end{array}$. This is also correct, although $\begin{array}{r} 8 \\ \underline{+\,4} \end{array}$ is preferred.

Part 2 Give each child or pair either prepared number cards or dice, blank paper, and cubes, links, or chips. They are to generate two numbers by tossing the dice or by drawing two cards. They then alternate between finding the sum and finding the difference ① ② .

If the children are working in pairs, suggest that for two given numbers one child find the sum and the other find the difference. Have them write the vertical notation only, unless some still wish to write the horizontal open sentence first. They try to determine the sum or or difference ① ② mentally and use the objects only to validate their answer. Some children may really enjoy the challenge of working abstractly here.

Give each child Student Booklet page 12 and let him check Goofy's paper and fix the wrong answers by validating with objects.

Give each child page 13. Tell them they are going to have a race. When you say "Go," they are to start finding answers ① ②. Give them about three minutes and then say "Stop." They trade papers and validate each other's answers using objects. You may decide winners if you wish by having them count how many they got right. Feel free to use more contests and sheets if your children need practice finding sums and differences and if they enjoy the challenge.

ACTIVITY S3 D (Optional)

This activity provides practice in finding sums and differences using the vertical notation.

Objectives

Regular

① solves $a + b = \square$ sentence 0-10

② solves $a - b = \square$ sentence 0-10

Preparatory

3 writes open + or - sentence 0-20

Organization

pairs (Parts 1 and 2)

large group (Part 1)

Materials

Student Booklet page 14 (Part 1)

Student Booklet page 15 (Part 2)

regular dice (Part 1)

blank dice and labels (Part 1)

2 large sheets of paper (Part 1)

links (Part 2)

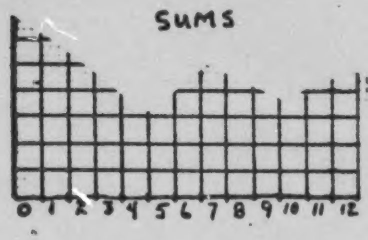
balance (Part 2)

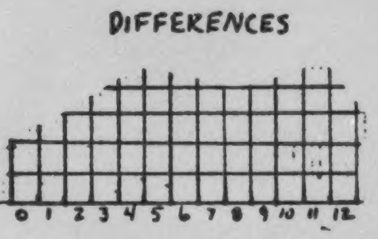
small washers (Part 2)

paper bags (Part 2) rocks (Part 2) paper (Part 2)	not in kit

Preparation

Part 1 Make two large graphs.





Label several pair of dice as follows:

One die	0, 1, 2, 3, 4, 5
Other die	5, 6, 7, 8, 9, 10

Part 2 Make several bags of chains. In each bag put 5 or 6 chains of one color and 5 or 6 chains of a second color. Each chain should have from 2-10 links. Have the children each bring in a small rock (bigger than a regular marble but smaller than a walnut) and a big rock (about the size of a walnut--no larger).

Teaching Suggestions

Do either of the parts. You may also choose to play any other addition or subtraction game you have in your classroom.

Part 1 In this part, in addition to adding and subtracting, the children are given the opportunity to make inferences about sums and differences.

Divide the class into pairs. Give each pair two regular dice or a set of the specially prepared "blank" dice. Each child also receives a copy of Student Booklet page 14.

Tell the children that each pair is to throw the dice 20 times. Those children with the regular numbered dice record and find the sum ① of the two numbers. Those children with the "blank" dice record and find the difference ② of the two numbers, always subtracting the smaller from the larger. Explain that in this way they will have a record of what they have done and will be able to help make the large graphs.

Steps for the experiment are:

1. Each partner rolls one of the dice.
2. Each partner records the numbers on page 14, and computes the sum or difference, depending on which dice they have.

$$\text{Ex.}\quad \begin{array}{r} 5 \\ -\ 1 \\ \hline 4 \end{array} \qquad \begin{array}{r} 2 \\ +\ 3 \\ \hline 5 \end{array}$$

3. Compare answers and validate.
4. Repeat Steps 1-3 19 more times. (You may have the children throw 10-15 times, if you wish.)
5. Switch dice with a pair that has a different type of dice. Do 20 throws with the new dice. Follow Steps 1-4.

When the children finish, each child should have 40 problems, 20 sums and 20 differences. There will be duplications. For example, a pair of children may throw a 4 and a 3 several times. Each time, the problem should be recorded and solved.

Next graph the children's results on the two large graphs that you prepared. Discuss the results.

Sums

Ask why the sums, six, seven, and eight seem to occur more often. (There are more ways to make 6, 7, and 8.)

Ask if it is possible to get a sum of zero with the regular dice. (No)

Ask what was the largest and smallest sums they could get. (12 and 2)

Differences

Ask why the differences, 4, 5, and 6 showed up more often. (There are more ways to make 4, 5, and 6.)

Ask if they could get a difference of 0 with the dice. (Yes)

Ask what was the largest and smallest difference they could get. (10 and 0)

Part 2 In this part the children participate in two activities which generate addition and subtraction problems. To use materials efficiently, part of the class may play Link Think while others do the weighing for Rock Talk.

Link Think. Divide the children into pairs. Give each pair one of the prepared sacks of chains and paper to record on. Each child pulls out a chain. If the chains are the same color, the children find the sum ① of the number of links in the chains altogether. If the chains are different colors, the children find the difference ② in the number of links. Each child writes the problem in vertical notation and solves. At various times throughout the activity, you may call "switch," and the children find a new partner.

Rock Talk. Have the children weigh their rocks ^(or rock) and record the weight(s) on Student Booklet page 15. When all of the children have found and recorded the weight(s) of (one rock) (their big and little rocks), they pair off and find the following sums and differences ① ②.

Sum of the two little rocks.

Difference of the two little rocks.

Sum of the ~~(or)~~ two big rocks.

Difference of the two big rocks.

(Sum of our rocks
Difference of our rocks)

For each partner the children have (they switch partners), they record the weights of the partners or friends' rocks and the four problems.

It works better to do only one rock – as indicated in parentheses above.

ACTIVITY S3 E

This activity provides practice in addition and subtraction.

Objectives

Regular

① solves $a + b = \square$ sentence 0-10

② solves $a - b = \square$ sentence 0-10

Preparatory

3 writes open + or - sentence 0-20

Organization

large group

individual

Materials

Student Booklet pages 16 and 17 (Part 1)

Student Booklet pages 18 and 19 (Part 2)

geoboards (Part 3)

rubber bands (Part 3)

paper (Part 3)

objects for validating (Parts 1, 2, 3)

Preparation

No special preparation is necessary.

Teaching Suggestions

This activity gives the children practice in addition and subtraction in various situations. Do all parts of this activity. Remind the children to validate.

Part 1 In this part the children use information given on a graph *to answer addition and subtraction questions* ① ②. They also review the dime and nickel, and compute change.

Student Booklet page 16. On this graphing page, you may need to discuss how to read a graph. Have the children solve using vertical notation. The problems should be written neatly on the right hand side of the paper.

Student Booklet page 17. On this money page, remind the children they are to write sentences using the = □ notation. You should watch for and help those children who write sentences of the form 7 - 10 = □. Ask these children to read what they have written and to represent the sentence with pictures or objects.

Part 2 In this part the children use what they learned in Topic 26 about paths to generate addition and subtraction situations.

Have the children lay *Student Booklet pages 18 and 19* side by side. Explain that page 18 shows paths in the woods. Along each path, some animals live. Next explain that 9 people took a walk. Each used a different path. *Tell the children they are going to add to find how many of each kind of insect or animal each person saw* ①.

Have the children look at page 19 and read the directions and column headings. Discuss the first entry in the chart. Explain that the entry tells that Goofy walks from point A to point B and then to point C. Have the children trace the path with their fingers. First they have to find how many butterflies Goofy saw. There were 5 between A and B and 7 between B and C. So that is $\begin{array}{r}5\\+\ 7\\\hline 12\end{array}$, as shown.

Discuss the other two entries in the same way. Note that there are no rabbits between B and C, so that is recorded as 0, thus the problem $\begin{array}{r}3\\+\ 0\\\hline\end{array}$.

If you feel the children need more direction, do the next row in the chart. After that, let them work independently or in pairs.

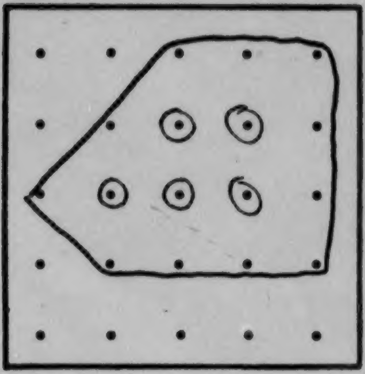
Encourage the children to validate.

Part 3 In this part the children use geoboards. Give each child or each pair of children ~~of~~ a geoboard and a rubber band, and paper.

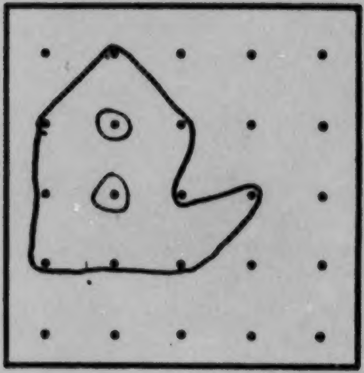
Have the children make a path on the geoboard with the rubber band. They count the number of pegs the rubberband touches and the number of pegs inside the path the rubber band makes. Then they find the difference ② between the two numbers. All work is recorded. They then make a new path and do the same for it.

Have the children make as many paths as they have time for.

Examples: (Inside dots or pegs are circled.)



$$\begin{array}{r} 11 \\ -\ 5 \\ \hline 6 \end{array}$$



$$\begin{array}{r} 9 \\ -\ 2 \\ \hline 7 \end{array}$$

Additional Suggestions

For pages 18 and 19: After the children have completed page 19 and they are sure their answers are correct, you may wish to do some difference problems. Ask such things as:

How many more butterflies did Martin see than Sally?

How many more ladybugs than rabbits did Symbol Simon see?

You may also wish to do a page similar to page 19. If so, the following paths were not used. ACB BAD CBE CDE ECD DCB

ADC BAC CEB ECA EDA DCE

ACTIVITY S3 F

In this activity the children practice the addition and subtraction facts 0-10. They also explore number relationships and patterns.

Objectives

Regular

① solves $a + b = \square$ sentence 0-10

② solves $a - b = \square$ sentence 0-10

Organization

individual

Materials

Student Booklet pages 20-24

objects for validating

Preparatory

No special preparation is necessary.

Teaching Suggestions

This activity provides practice in addition and subtraction ① ② and some opportunity to discuss commutativity of addition, the relationship between addition and subtraction, and zero as an addition identity.

Student Booklet pages 20-22. On these pages after the children have finished, discuss that $\begin{array}{r} 2 \\ +\ 4 \\ \hline \end{array}$ and $\begin{array}{r} 4 \\ +\ 2 \\ \hline \end{array}$ gives the same answer (commutativity) and that when zero is added to or subtracted from any number, there is no change. $6 - 0 = \boxed{0}$, $6 + 0 = \boxed{0}$.

Student Booklets pages 23 and 24. The children write and solve families of numbers. They should be familiar with these. However, this time when the children have completed page 23, discuss the families using the p - p = W diagram.

For example, each family has the basic $\begin{array}{|c|c|}\hline \multicolumn{2}{|c|}{\text{WHOLE}} \\ \hline \text{PART} & \text{PART} \\ \hline \end{array}$.

for 8 - 2 = $\boxed{}$ the diagram would be $\begin{array}{|c|c|}\hline \multicolumn{2}{|c|}{8} \\ \hline 2 & \\ \hline \end{array}$.

The missing part is 6. Thus $\begin{array}{|c|c|}\hline \multicolumn{2}{|c|}{8} \\ \hline 2 & 6 \\ \hline \end{array}$, gives the family. This is the only time all 3 numbers are filled in on the chart.

p + p = W (order doesn't matter)

$$\begin{array}{r} 2\ \text{p} \\ \underline{+\ 6\ \text{p}} \\ 8\ \text{W} \end{array} \quad \begin{array}{r} 6\ \text{p} \\ \underline{+\ 2\ \text{p}} \\ 8\ \text{W} \end{array} \quad \text{or} \quad \begin{array}{ccccc} \text{p} & & \text{p} & & \text{W} \\ 2 & + & 6 & = & 8 \\ 6 & + & 2 & = & 8 \end{array}$$

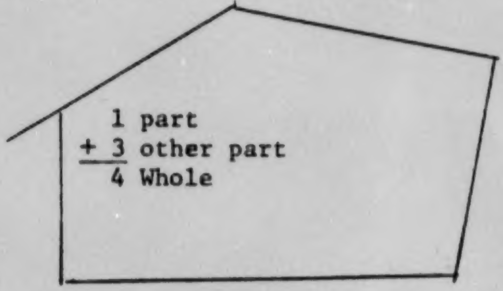
other
W - p = p

$$\begin{array}{r} 8\ \text{W} \\ \underline{-\ 2\ \text{p}} \\ 6\ \text{p} \end{array} \quad \text{or} \quad \begin{array}{ccccc} \text{W} & & \text{p} & & \text{p} \\ 8 & - & 2 & = & 6 \end{array}$$

other
W - p = p

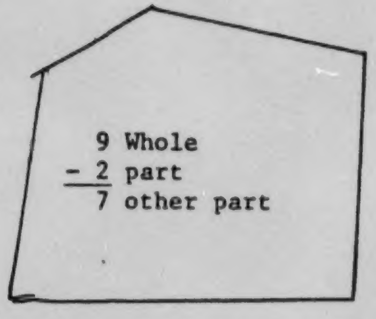
$$\begin{array}{r} 8\ \text{W} \\ \underline{-\ 6\ \text{p}} \\ 2\ \text{p} \end{array} \quad \text{or} \quad \begin{array}{ccccc} \text{W} & & \text{p} & & \text{p} \\ 8 & - & 6 & = & 2 \end{array}$$

On page 24 you may have the children identify the parts and the whole in the family member given. For example:



$$\begin{array}{rl} 1 & \text{part} \\ \underline{+\ 3} & \text{other part} \\ 4 & \text{Whole} \end{array}$$

or



$$\begin{array}{rl} 9 & \text{Whole} \\ \underline{-\ 2} & \text{part} \\ 7 & \text{other part} \end{array}$$

If the children do not understand, do not push the point. It will be explored again in later topics.

TOPIC INVENTORY S-3

Objectives

1 Writes $a + b = \square$ sentence 0-10

2 Writes $a - b = \square$ sentence 0-10

Organization

Large group

Materials

Test pages for each child, stapled together.

Pencil for each child.

Time

6 minutes

Instructions

1. Since this is a timed test on knowledge of basic facts up to 10, the children should not be permitted to use objects.
2. Page A tests Objective 1 (addition) and page B tests Objective 2 (subtraction).
3. Feel free to read the directions more than once if necessary.
4. Read these directions to the children.
    a) Print your name at the top of the first page--page A (Pause)
    b) Look at the words at the top. They say, "Solve the number sentence." In the middle of the page, the word says, "Add." Now let's look at the second page--page B. The words at the

top also say, "Solve the number sentence." In the middle of this page, the word says, "Subtract." Alright, begin. As soon as you have finished work with page A, you can turn to page B.

5. At the end of 6 minutes, collect the test papers.

Rating

Objective	Ratings		
	M	P	N
1 & 2	8-10	6-7	0-5

name ______________________________

Write a sentence with a □ for each story.
Then solve it.

---

10 cards

<table><tr><td colspan="2">10</td></tr><tr><td>6</td><td></td></tr></table>

6 say "Happy Birthday."
Some say "Get Well."
How many say "Get Well"?

10 - 6 = $\boxed{4}$

---

15 cards

<table><tr><td colspan="2">15</td></tr><tr><td>8</td><td></td></tr></table>

Some say "I Love You."
8 say "See You Soon."
How many say "I Love You"?

15 - 8 = $\boxed{7}$

Some cards

<table><tr><td colspan="2"></td></tr><tr><td>4</td><td>5</td></tr></table>

4 say "Boo!"
5 say "Be My Valentine."
How many cards
are there altogether?

4 + 5 = $\boxed{9}$

---

11 cards

<table><tr><td colspan="2">11</td></tr><tr><td>2</td><td></td></tr></table>

Some say "Hello."
2 say "I Miss You."
How many say "Hello"?

11 - 2 = $\boxed{9}$

53A

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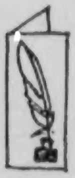
7  cards

<table><tr><td colspan="2">7</td></tr><tr><td>4</td><td></td></tr></table>

4 say "Write Soon."
Some say "Thank You."
How many say "Thank You"?

7 - 4 = $\boxed{3}$

Some cards

<table><tr><td colspan="2"></td></tr><tr><td>8</td><td>3</td></tr></table>

8 say "Happy Mother's Day."
3 say "Happy Father's Day."
How many cards
are there altogether?

8 + 3 = $\boxed{11}$

name

Write a sentence for each story. Then solve it.

9 books

9	
2	

2 are about birds.
Some are about lakes.

How many are about lakes?

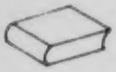
$9-2=\boxed{7}$ book about lake

Some books

6	6

6 are about rocks.
6 are about horses.
How many books altogether?

$6+6=\boxed{12}$ books altogether

Some  books

7	6

7 are about frogs.
6 are about turtles.
How many books altogether?

$7+6=\boxed{13}$ books altogether

8 books

8	
3	

Some are about jokes.
3 are about cars.
How many are about jokes?

$8-3=\boxed{5}$ book about jokes

13 books

13	
5	

5 are about ghosts.
Some are about water.
How many are about water?

$13-5=\boxed{8}$ books about water

10 books

10	
3	

Some are about people.
3 are about trucks.
How many are about people?

$10-3=\boxed{7}$ books about people.

name ______________________

Write a sentence. Then solve it.

It is 14 miles to the lake.

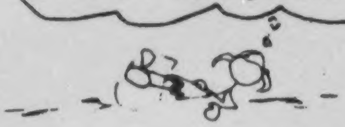
I walk 6 miles. How many miles are left?

14	
6	

14 - 6 = 8 miles left to walk

I slept 9 hours last night.

I slept 3 hours today. How many hours is that altogether?



9	3

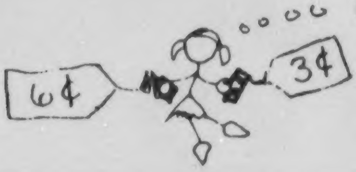
9+3 = 12 hours

---

3 big steps. Some little steps. 10 steps altogether. How many little steps?

10	
3	

10-3 = 7 little steps



How much for both of these?

6	3

6+3 = 9¢

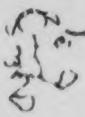
I see some ants. 5 are red. 6 are brown. How many ants altogether?

5	6

5+6 = 11 ants

53A

There are 12 birds. 8 fly away. How many are left?



12	
8	

12-8 = 4 birds are left.

name________________________________ 5

Write a sentence. Then solve it. Read carefully.

1. Jeff got 6 new cars.
He had 7 before.
How many does he have now?

<table><tr><td colspan="2"></td></tr><tr><td>6</td><td>7</td></tr></table>

$6 + 7 = \boxed{13}$

He has 13 cars now.

2. Terri gave away 4 cars.
She had 11 before.
How many does she have left?

<table><tr><td colspan="2">11</td></tr><tr><td>4</td><td></td></tr></table>

$11 - 4 = \boxed{7}$

Terri has 7 cars left.

3. Kim wants 10 cars.
Her mother gave her 2 cars.
How many more cars does she
need to have 10 cars?

<table><tr><td colspan="2">10</td></tr><tr><td>2</td><td></td></tr></table>

$10 - 2 = \boxed{8}$

Kim needs 8 more cars.

4. Mark gave 5 cars to Kevin.
He gave some cars to Jenny.
He gave away 8 cars altogether.
How many cars did he give to Jenny?

<table><tr><td colspan="2">8</td></tr><tr><td>5</td><td></td></tr></table>

$8 - 5 = \boxed{3}$

Mark gave 3 cars to Jenny.

5. Mike got 9 cars.
Then he got 3 more cars.
How many does he have now?

<table><tr><td colspan="2"></td></tr><tr><td>9</td><td>3</td></tr></table>

$9 + 3 = \boxed{12}$

Mike has 12 cars now.

6. Kara put 4 of her cars with
8 of Karl's cars. How many
cars were there altogether?

<table><tr><td colspan="2"></td></tr><tr><td>4</td><td>8</td></tr></table>

$4 + 8 = \boxed{12}$

There are 12 cars altogether.

7. Chris got 9 cars.
How many more does he need
to have 15 cars altogether?

<table><tr><td colspan="2">15</td></tr><tr><td>9</td><td></td></tr></table>

$15 - 9 = \boxed{6}$

Chris needs 6 more cars.

8. John had 20 cars. He gave
away 11. How many does he
have left?

<table><tr><td colspan="2">20</td></tr><tr><td>11</td><td></td></tr></table>

$20 - 11 = \boxed{9}$

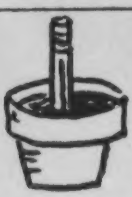
John has 9 cars left

PENCILS IN POTS

name

6

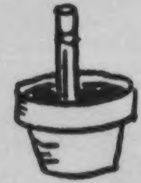
Write a sentence for each story, Then solve it.



10	
2	

The pencil is 10 cubes long.
Some of it is in the dirt.
2 cubes of it are not in the dirt.
How much of it is in the dirt?

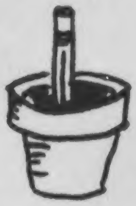
$10-2=\boxed{8}$ cubes



4	5

4 cubes of the pencil's length
are in the dirt.
5 cubes of it are not in the dirt.
How long is the pencil?

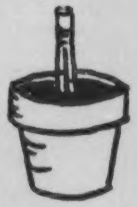
$4+5=\boxed{9}$ cubes



8	
1	

The pencil is 8 cubes long.
1 cube of it is in the dirt.
How much is not in the dirt?

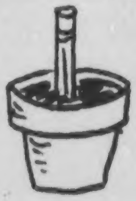
$8-1=\boxed{7}$ cubes



11	
3	

The pencil is 11 cubes long.
3 cubes of it are not in the dirt.
How much of it is in the dirt?

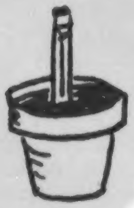
$11-3=\boxed{8}$ cubes



4	3

4 cubes of the pencil's length
are in the dirt.
3 cubes of it are not in the dirt.
How long is the pencil?

$4+3=\boxed{7}$ cubes



6	7

6 cubes of the pencil's length
are in the dirt.
7 cubes of it are not in the dirt.
How long is the pencil?

$6+7=\boxed{13}$ cubes

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name ______________________________

Write a sentence for each story. Then solve it.

1. I have 8 chairs.
How many more do I need
to make 11 chairs?

11	
8	

$11-8=\boxed{3}$ chairs

2. I hopped 6 times.
Then I hopped 7 times.
How many times did I hop?

6	7

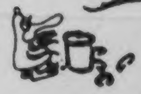
$6+7=\boxed{13}$ hops

3. I have 9 plants.
2 are bean plants.
The rest are pea plants.
How many pea plants are there?

9	
2	

$9-2=\boxed{7}$ pea plants

4. I have 10 links.
2 links are in the can.
How many links are not
in the can?



10	
2	

$10-2=\boxed{8}$ links

5. 6 big planes join
3 small planes.
How many planes are there
altogether?

6	3

$6+3=\boxed{9}$ planes

6. I found 5¢.
I had 7¢.
How much money do I
have now?

5	7

$5+7=\boxed{12}$ ¢

538

name ______________________________

LENGTHS OF FIVE PENCILS

A 6 links B 7 links C 3 links D 10 links E 8 links

Write a sentence about the lengths. Then solve it.

1. How long are A and E together?		6	8	6+8= $\boxed{14}$ links
2. How long would B be if you took away 5 links?	7	5		7-5= $\boxed{2}$ links
3. How long would C be if you added 6 links?		3	6	3+6 = $\boxed{9}$ links
4. How long would D and C joined together be?		3	10	3+10= $\boxed{13}$ links
5. How long would D be if you took away 7 links?	10	7		10-7= $\boxed{3}$ links
6. How long would B and E be together?		7	8	7+8= $\boxed{15}$ links
7. How long would A be if you added 5 links?		6	5	6+5= $\boxed{11}$ links

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230

name ______________________________ 9

Write the sentences in up and down form. Then solve.

4 + 5 = ☐ 4 + 5 9	4 - 3 = ☐ 4 - 3 1	5 + 3 = ☐ 5 + 3 8	10 - 4 = ☐ 10 - 4 6	7 + 2 = ☐ 7 + 2 9
9 - 6 = ☐ 9 - 6 3	3 + 5 = ☐ 3 + 5 8	7 - 7 = ☐ 7 - 7 0	9 + 0 = ☐ 9 + 0 9	1 + 6 = ☐ 1 + 6 7
8 - 2 = ☐ 8 - 2 6	5 - 4 = ☐ 5 - 4 1	6 + 4 = ☐ 6 + 4 10	8 + 1 = ☐ 8 + 1 9	7 - 6 = ☐ 7 - 6 1
10 - 8 = ☐ 10 - 8 2	5 + 2 = ☐ 5 + 2 7	8 - 4 = ☐ 8 - 4 4	9 - 8 = ☐ 9 - 8 1	7 + 0 = ☐ 7 + 0 7
9 - 4 = ☐ 9 - 4 5	10 - 5 = ☐ 10 - 5 5	6 + 2 = ☐ 6 + 2 8	1 + 9 = ☐ 1 + 9 10	8 - 1 = ☐ 8 - 1 7

53C

name____

10

Write the sentences in up and down form. Then solve.

10 - 1 = ☐ 10 - 1 9	4 + 6 = ☐ 4 + 6 10	9 - 3 = ☐ 9 - 3 6	7 + 1 = ☐ 7 + 1 8	0 + 5 = ☐ 0 + 5 5
6 - 6 = ☐ 6 - 6 0	8 - 7 = ☐ 8 - 7 1	7 + 2 = ☐ 7 + 2 9	6 + 1 = ☐ 6 + 1 7	8 - 5 = ☐ 8 - 5 3
9 - 7 = ☐ 9 - 7 2	6 - 2 = ☐ 6 - 2 4	5 + 5 = ☐ 5 + 5 10	2 + 3 = ☐ 2 + 3 5	3 + 4 = ☐ 3 + 4 7
5 - 0 = ☐ 5 - 0 5	9 - 5 = ☐ 9 - 5 4	8 - 8 = ☐ 8 - 8 0	2 - 1 = ☐ 2 - 1 1	6 - 3 = ☐ 6 - 3 3
1 + 8 = ☐ 1 + 8 9	3 + 7 = ☐ 3 + 7 10	4 + 4 = ☐ 4 + 4 8	3 + 6 = ☐ 3 + 6 9	2 + 8 = ☐ 2 + 8 10

53C

name______________________________ 11

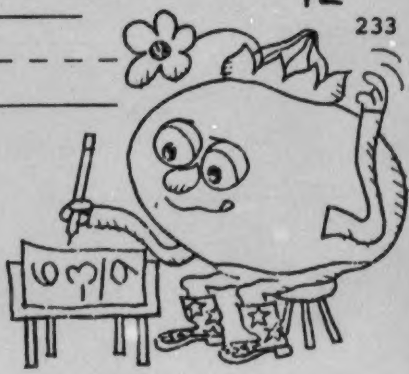
Write these as sentences with a ☐ . Then solve.

10 − 0 10 − 0 = $\boxed{10}$	6 − 4 6 − 4 = $\boxed{2}$	9 + 1 9 + 1 = $\boxed{10}$	8 − 6 8 − 6 = $\boxed{2}$
2 + 6 2 + 6 = $\boxed{8}$	7 − 5 7 − 5 = $\boxed{2}$	6 + 3 6 + 3 = $\boxed{9}$	9 − 2 9 − 2 = $\boxed{7}$
1 + 7 1 + 7 = $\boxed{8}$	6 − 0 6 − 0 = $\boxed{6}$	8 + 2 8 + 2 = $\boxed{10}$	7 − 3 7 − 3 = $\boxed{4}$
9 − 1 9 − 1 = $\boxed{8}$	7 + 3 7 + 3 = $\boxed{10}$	4 − 4 4 − 4 = $\boxed{0}$	10 − 6 10 − 6 = $\boxed{4}$
5 + 4 5 + 4 = $\boxed{9}$	2 + 7 2 + 7 = $\boxed{9}$	0 + 8 0 + 8 = $\boxed{8}$	10 − 2 10 − 2 = $\boxed{8}$

12

233

name ______________________________



Check Goofy's paper.
Fix the answers that are wrong.

$$\begin{array}{r} 10 \\ -5 \\ \hline \cancel{4} \\ 5 \end{array}$$ ✓

$$\begin{array}{r} 8 \\ +1 \\ \hline 9 \end{array}$$ C

$$\begin{array}{r} 6 \\ +2 \\ \hline \cancel{7} \\ 8 \end{array}$$ ✓

$$\begin{array}{r} 9 \\ -3 \\ \hline 6 \end{array}$$ C

$$\begin{array}{r} 0 \\ +5 \\ \hline \cancel{0} \\ 5 \end{array}$$ ✓

$$\begin{array}{r} 4 \\ -2 \\ \hline 2 \end{array}$$ C

$$\begin{array}{r} 9 \\ -4 \\ \hline \cancel{4} \\ 5 \end{array}$$ ✓

$$\begin{array}{r} 2 \\ -1 \\ \hline \cancel{0} \\ 1 \end{array}$$ ✓

$$\begin{array}{r} 3 \\ +4 \\ \hline 7 \end{array}$$ C

$$\begin{array}{r} 8 \\ +2 \\ \hline 10 \end{array}$$ C

$$\begin{array}{r} 6 \\ -3 \\ \hline \cancel{9} \\ 3 \end{array}$$ ✓

$$\begin{array}{r} 8 \\ -8 \\ \hline \cancel{8} \\ 0 \end{array}$$ ✓

$$\begin{array}{r} 3 \\ +4 \\ \hline \cancel{6} \\ 7 \end{array}$$ ✓

$$\begin{array}{r} 3 \\ +5 \\ \hline \cancel{9} \\ 8 \end{array}$$ ✓

$$\begin{array}{r} 6 \\ +1 \\ \hline 7 \end{array}$$

$$\begin{array}{r} 3 \\ +3 \\ \hline \cancel{5} \\ 6 \end{array}$$ ✓

$$\begin{array}{r} 3 \\ +2 \\ \hline \cancel{2} \\ 1 \end{array}$$ ✓

$$\begin{array}{r} 7 \\ +4 \\ \hline \cancel{9} \\ 11 \end{array}$$ ✓

S3C

234 Find the sums or differences. 13

name

$\begin{array}{r}5\\-0\\\hline 5\end{array}$	$\begin{array}{r}8\\-6\\\hline 2\end{array}$	$\begin{array}{r}1\\+7\\\hline 8\end{array}$	$\begin{array}{r}0\\+0\\\hline 0\end{array}$	$\begin{array}{r}6\\-4\\\hline 2\end{array}$
$\begin{array}{r}1\\+5\\\hline 6\end{array}$	$\begin{array}{r}2\\+2\\\hline 4\end{array}$	$\begin{array}{r}7\\-3\\\hline 4\end{array}$	$\begin{array}{r}9\\-6\\\hline 3\end{array}$	$\begin{array}{r}2\\+5\\\hline 7\end{array}$
$\begin{array}{r}10\\-6\\\hline 4\end{array}$	$\begin{array}{r}1\\+3\\\hline 4\end{array}$	$\begin{array}{r}5\\-4\\\hline 1\end{array}$	$\begin{array}{r}8\\+2\\\hline 10\end{array}$	$\begin{array}{r}3\\-3\\\hline 0\end{array}$
$\begin{array}{r}5\\+4\\\hline 1\end{array}$	$\begin{array}{r}4\\-2\\\hline 2\end{array}$	$\begin{array}{r}4\\+4\\\hline 8\end{array}$	$\begin{array}{r}8\\-5\\\hline 3\end{array}$	$\begin{array}{r}9\\-5\\\hline 4\end{array}$

name____ 14

SUMS Throw the dice 20 times. Find the sum of each throw.

varies

DIFFERENCES Throw the dice 20 times. Find the difference for each throw. Subtract the smaller number from the larger.

varies

name ------ If you choose to have the children do only one rock, change this page as shown. --

Find the weights of One Rock ~~your rocks.~~ Use small washers.

MY ~~BIG~~ ROCK WEIGHS ______________ SMALL WASHERS.

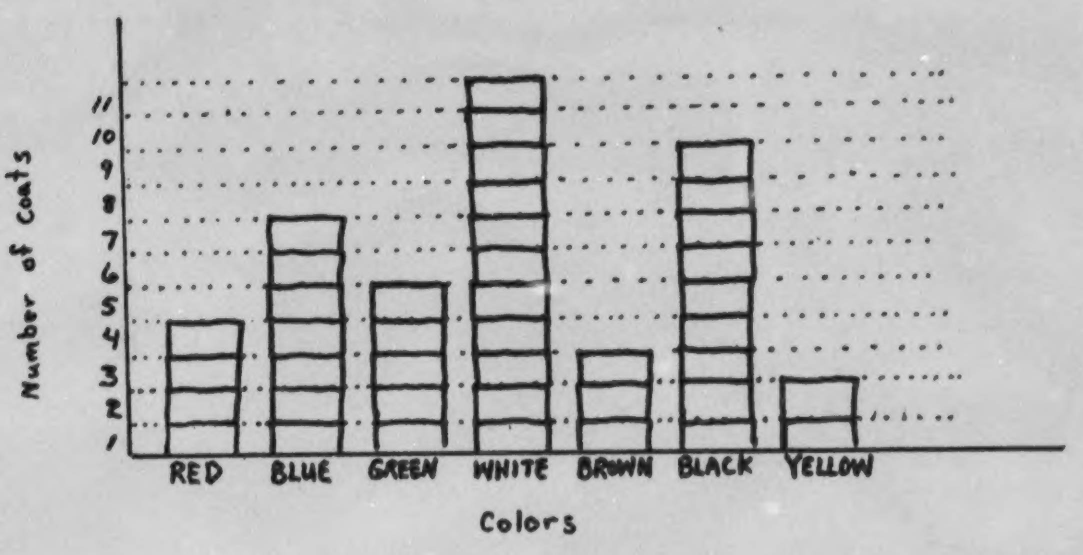
~~MY LITTLE ROCK WEIGHS ______________ SMALL WASHERS.~~

Fill in the chart.

My Rock. Weight ~~of~~ ~~my~~ friend's ~~BIG~~ rock	Weight of my friend's ~~LITTLE~~ rock	SUM of our ~~two big~~ rocks	DIFFERENCE of ~~two~~ our ~~big~~ rocks	~~SUM of two little rocks~~	~~DIFFERENCE of two little rocks~~

name

COATS



Some people counted all the coats in a room. Above is the graph they drew telling how many coats there were of each color. Answer the questions. Find the sum or difference.

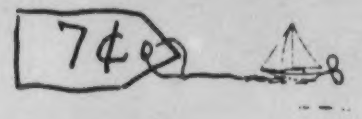
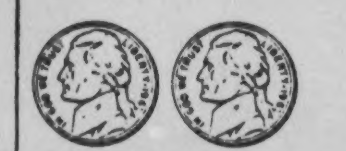
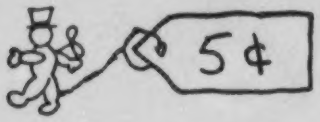
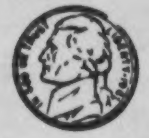
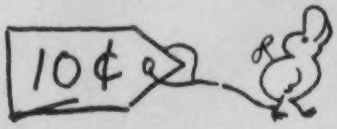
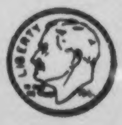
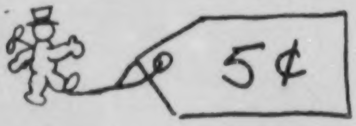
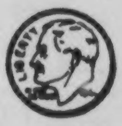
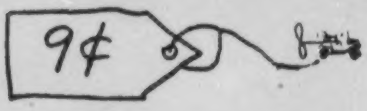
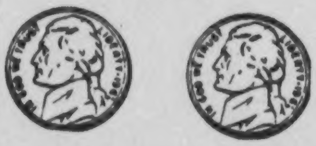
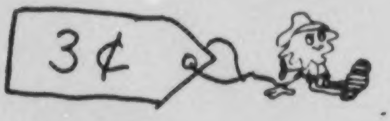
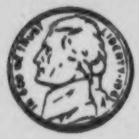
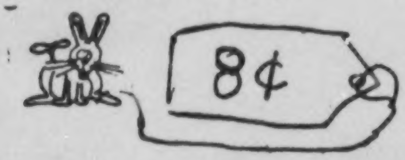
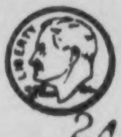
1. How many more blues than reds?
   7 − 4 = $\boxed{3}$
2. How many more whites than blacks?
   11 − 9 = $\boxed{2}$
3. How many greens and browns altogether?
   5 + 3 = $\boxed{8}$
4. How many more blues than yellows?
   7 − 2 = $\boxed{5}$
5. How many more blacks than blues?
   9 − 7 = $\boxed{2}$
6. How many reds and greens altogether?
   4 + 5 = $\boxed{9}$
7. How many blacks and yellows altogether?
   9 + 2 = $\boxed{11}$
8. How many blues and whites altogether?
   7 + 11 = $\boxed{18}$

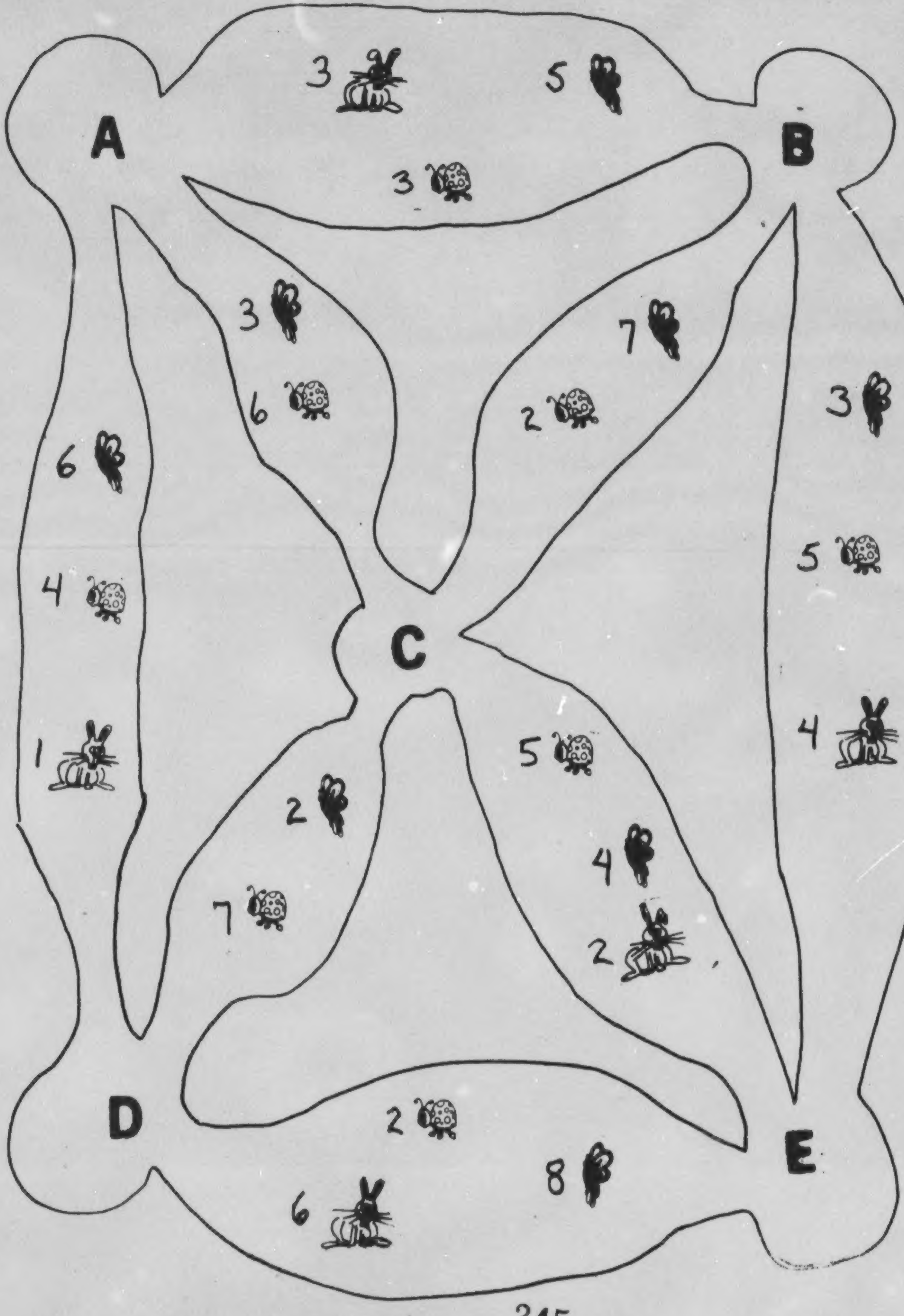
S3E

name______________________________

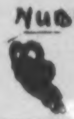
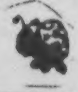
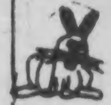
How much change should you get?
Write a sentence. Then solve it.

dime = 10¢
nickel = 5¢

		sentence
1. You want to buy: 	You pay: 	10-7= $\boxed{3}$ ¢
2. You want to buy: 	You pay: 	5-5 = $\boxed{0}$ ¢
3. You want to buy: 	You pay: 	10-10 = $\boxed{0}$ ¢
4. You want to buy: 	You pay: 	10-5 = $\boxed{5}$ ¢
5. You want to buy: 	You pay: 	10-9 = $\boxed{1}$ ¢
6. You want to buy: 	You pay: 	5-3 = $\boxed{2}$ ¢
7. You want to buy: 	You pay: 	10-8 = $\boxed{2}$ ¢


A
B
C
D
E

name

PERSON	PATH	NUBER OF  SEEN	NUMBER OF  SEEN	NUMBER OF  SEEN
GOOFY	A to B to C	5 + 7 12	3 + 2 5	3 + 0 3
SILLY	B to E to D	3 + 8 11	5 + 2 7	4 + 6 10
FRANNY	C to D to A	2 + 6 8	7 + 4 11	0 + 1 1
NUTTY	E to C to B	4 + 7 11	5 + 2 7	2 + 0 2
Mr. D. Zine	D to E to C	8 + 4 12	2 + 5 7	6 + 2 8
Sally Shark	A to C to D	3 + 2 5	6 + 7 13	0 + 0 0
SYMBOL SIMON	B to E to C	3 + 4 7	5 + 5 10	4 + 2 6
PEEP	A to B to E	5 + 3 8	3 + 5 8	3 + 4 7
Martin the Munch	C to A to D	3 + 6 9	6 + 4 10	0 + 1 1

name ______________________________

20

Find the sums or differences.

What patterns do you see?

$$\begin{array}{r} 0 \\ +0 \\ \hline 0 \end{array} \quad \begin{array}{r} 1 \\ +1 \\ \hline 2 \end{array} \quad \begin{array}{r} 2 \\ +2 \\ \hline 4 \end{array} \quad \begin{array}{r} 3 \\ +3 \\ \hline 6 \end{array} \quad \begin{array}{r} 4 \\ +4 \\ \hline 8 \end{array} \quad \begin{array}{r} 5 \\ +5 \\ \hline 10 \end{array}$$

$$\begin{array}{r} 10 \\ -5 \\ \hline 5 \end{array} \quad \begin{array}{r} 8 \\ -4 \\ \hline 4 \end{array} \quad \begin{array}{r} 6 \\ -3 \\ \hline 3 \end{array} \quad \begin{array}{r} 4 \\ -2 \\ \hline 2 \end{array} \quad \begin{array}{r} 2 \\ -1 \\ \hline 1 \end{array} \quad \begin{array}{r} 0 \\ -0 \\ \hline 0 \end{array}$$

$$\begin{array}{r} 9 \\ +1 \\ \hline 10 \end{array} \quad \begin{array}{r} 8 \\ +1 \\ \hline 9 \end{array} \quad \begin{array}{r} 7 \\ +1 \\ \hline 8 \end{array} \quad \begin{array}{r} 9 \\ -1 \\ \hline 8 \end{array} \quad \begin{array}{r} 8 \\ -1 \\ \hline 7 \end{array} \quad \begin{array}{r} 7 \\ -1 \\ \hline 6 \end{array}$$

$$\begin{array}{r} 10 \\ -8 \\ \hline 2 \end{array} \quad \begin{array}{r} 8 \\ -6 \\ \hline 2 \end{array} \quad \begin{array}{r} 6 \\ -4 \\ \hline 2 \end{array} \quad \begin{array}{r} 4 \\ -2 \\ \hline 2 \end{array} \quad \begin{array}{r} 2 \\ -0 \\ \hline 2 \end{array} \quad \begin{array}{r} 9 \\ -7 \\ \hline 2 \end{array}$$

$$\begin{array}{r} 1 \\ +3 \\ \hline 4 \end{array} \quad \begin{array}{r} 3 \\ +5 \\ \hline 8 \end{array} \quad \begin{array}{r} 7 \\ -5 \\ \hline 2 \end{array} \quad \begin{array}{r} 5 \\ -3 \\ \hline 2 \end{array} \quad \begin{array}{r} 3 \\ -1 \\ \hline 2 \end{array} \quad \begin{array}{r} 1 \\ -0 \\ \hline 1 \end{array}$$

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name ______________________________ 21

Find the sums or differences. How are the pairs related?

$$\begin{array}{r} 10 \\ -2 \\ \hline 8 \end{array} \quad \begin{array}{r} 8 \\ +2 \\ \hline 10 \end{array} \qquad\qquad \begin{array}{r} 9 \\ -3 \\ \hline 6 \end{array} \quad \begin{array}{r} 6 \\ +3 \\ \hline 9 \end{array} \qquad\qquad \begin{array}{r} 8 \\ -5 \\ \hline 3 \end{array} \quad \begin{array}{r} 3 \\ +5 \\ \hline 8 \end{array}$$

$$\begin{array}{r} 7 \\ -4 \\ \hline 3 \end{array} \quad \begin{array}{r} 3 \\ +4 \\ \hline 7 \end{array} \qquad\qquad \begin{array}{r} 6 \\ -1 \\ \hline 5 \end{array} \quad \begin{array}{r} 5 \\ +1 \\ \hline 6 \end{array} \qquad\qquad \begin{array}{r} 5 \\ -0 \\ \hline 5 \end{array} \quad \begin{array}{r} 5 \\ +0 \\ \hline 5 \end{array}$$

$$\begin{array}{r} 4 \\ -4 \\ \hline 0 \end{array} \quad \begin{array}{r} 0 \\ +4 \\ \hline 4 \end{array} \qquad\qquad \begin{array}{r} 10 \\ -6 \\ \hline 4 \end{array} \quad \begin{array}{r} 4 \\ +6 \\ \hline 10 \end{array} \qquad\qquad \begin{array}{r} 9 \\ -4 \\ \hline 5 \end{array} \quad \begin{array}{r} 5 \\ +4 \\ \hline 9 \end{array}$$

S3F

$$\begin{array}{r} 8 \\ -2 \\ \hline 6 \end{array} \quad \begin{array}{r} 6 \\ +2 \\ \hline 8 \end{array} \qquad\qquad \begin{array}{r} 7 \\ -5 \\ \hline 2 \end{array} \quad \begin{array}{r} 2 \\ +5 \\ \hline 7 \end{array} \qquad\qquad \begin{array}{r} 6 \\ -5 \\ \hline 1 \end{array} \quad \begin{array}{r} 1 \\ +5 \\ \hline 6 \end{array}$$

name ____________________

Find the sums or differences. How are the pairs related?

$1+4=\boxed{5}$
$4+1=\boxed{5}$

$10-3=\boxed{7}$
$10-7=\boxed{3}$

$2+3=\boxed{5}$
$3+2=\boxed{5}$

$9-2=\boxed{7}$
$9-7=\boxed{2}$

$3+7=\boxed{10}$
$7+3=\boxed{10}$

$8-6=\boxed{2}$
$8-2=\boxed{6}$

$4+6=\boxed{10}$
$6+4=\boxed{10}$

$6-2=\boxed{4}$
$6-4=\boxed{2}$

$5-3=\boxed{2}$
$5-2=\boxed{3}$

$8+0=\boxed{8}$
$0+8=\boxed{8}$

$9-1=\boxed{8}$
$9-8=\boxed{1}$

$7+1=\boxed{8}$
$1+7=\boxed{8}$

$10-4=\boxed{6}$
$10-6=\boxed{4}$

$3+5=\boxed{8}$
$5+3=\boxed{8}$

$4-0=\boxed{4}$
$4-4=\boxed{0}$

S3F

name________________ 23

NUMBER FAMILIES

Find the sums or differences.

$$\begin{array}{rrrr} 3 & 7 & 7 & 4 \\ +4 & -3 & -4 & +3 \\ \hline 7 & 4 & 3 & 7 \end{array}$$

$$\begin{array}{|c|c|} \hline \multicolumn{2}{|c|}{7} \\ \hline 3 & 4 \\ \hline \end{array}$$

$$\begin{array}{|c|c|} \hline \multicolumn{2}{|c|}{10} \\ \hline 8 & 2 \\ \hline \end{array}$$

$$\begin{array}{rrrr} 10 & 8 & 2 & 10 \\ -2 & +2 & +8 & -8 \\ \hline 8 & 10 & 10 & 2 \end{array}$$

$$\begin{array}{rrrr} 6 & 3 & 9 & 9 \\ +3 & +6 & -3 & -6 \\ \hline 9 & 9 & 6 & 3 \end{array}$$

$$\begin{array}{|c|c|} \hline \multicolumn{2}{|c|}{9} \\ \hline 3 & 6 \\ \hline \end{array}$$

$$\begin{array}{|c|c|} \hline \multicolumn{2}{|c|}{9} \\ \hline 5 & 4 \\ \hline \end{array}$$

$$\begin{array}{rrrr} 9 & 9 & 5 & 4 \\ -5 & -4 & +4 & +5 \\ \hline 4 & 5 & 9 & 9 \end{array}$$

$$\begin{array}{rrrr} 2 & 1 & 3 & 3 \\ +1 & +2 & -1 & -2 \\ \hline 3 & 3 & 2 & 1 \end{array}$$

$$\begin{array}{|c|c|} \hline \multicolumn{2}{|c|}{3} \\ \hline 1 & 2 \\ \hline \end{array}$$

$$\begin{array}{|c|c|} \hline \multicolumn{2}{|c|}{8} \\ \hline 6 & 2 \\ \hline \end{array}$$

$$\begin{array}{rrrr} 6 & 2 & 8 & 8 \\ +2 & +6 & -6 & -2 \\ \hline 8 & 8 & 2 & 6 \end{array}$$

$$\begin{array}{rrrr} 4 & 2 & 6 & 6 \\ +2 & +4 & -2 & -4 \\ \hline 6 & 6 & 4 & 2 \end{array}$$

$$\begin{array}{|c|c|} \hline \multicolumn{2}{|c|}{6} \\ \hline 4 & 2 \\ \hline \end{array}$$

$$\begin{array}{|c|c|} \hline \multicolumn{2}{|c|}{10} \\ \hline 9 & 1 \\ \hline \end{array}$$

$$\begin{array}{rrrr} 10 & 10 & 1 & 9 \\ -1 & -9 & +9 & +1 \\ \hline 9 & 1 & 10 & 10 \end{array}$$

53F

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name______________________________ 24

NUMBER FAMILIES

Write the other 3 members of each family.
Find the sums and differences.

$$\begin{array}{r}1\\+3\\\hline 4\end{array}\quad\begin{array}{r}3\\+1\\\hline 4\end{array}\quad\begin{array}{r}4\\-3\\\hline 1\end{array}\quad\begin{array}{r}4\\-1\\\hline 3\end{array}$$

$$\begin{array}{r}9\\-2\\\hline 7\end{array}\quad\begin{array}{r}9\\-7\\\hline 2\end{array}\quad\begin{array}{r}7\\+2\\\hline 9\end{array}\quad\begin{array}{r}2\\+7\\\hline 9\end{array}$$

$$\begin{array}{r}3\\+5\\\hline 8\end{array}\quad\begin{array}{r}5\\+3\\\hline 8\end{array}\quad\begin{array}{r}8\\-3\\\hline 5\end{array}\quad\begin{array}{r}8\\-5\\\hline 3\end{array}$$

$$\begin{array}{r}7\\-6\\\hline 1\end{array}\quad\begin{array}{r}7\\-1\\\hline 6\end{array}\quad\begin{array}{r}1\\+6\\\hline 7\end{array}\quad\begin{array}{r}6\\+1\\\hline 7\end{array}$$

$$\begin{array}{r}10\\-7\\\hline 3\end{array}\quad\begin{array}{r}10\\-3\\\hline 7\end{array}\quad\begin{array}{r}3\\+7\\\hline 10\end{array}\quad\begin{array}{r}7\\+3\\\hline 10\end{array}$$

$$\begin{array}{r}5\\+2\\\hline 7\end{array}\quad\begin{array}{r}2\\+5\\\hline 7\end{array}\quad\begin{array}{r}7\\-5\\\hline 2\end{array}\quad\begin{array}{r}7\\-2\\\hline 5\end{array}$$

53F

A

name____

Topic Inventory S3

Solve the number sentence.

$4+5=\boxed{9}$ $3+1=\boxed{4}$ $0+8=\boxed{8}$

$6+2=\boxed{8}$ $3+3=\boxed{6}$

Add.

$\begin{array}{r} 4 \\ +4 \\ \hline 8 \end{array}$ $\begin{array}{r} 2 \\ +7 \\ \hline 9 \end{array}$ $\begin{array}{r} 5 \\ +3 \\ \hline 8 \end{array}$ $\begin{array}{r} 9 \\ +0 \\ \hline 9 \end{array}$ $\begin{array}{r} 1 \\ +7 \\ \hline 8 \end{array}$

Obj. 1 solves a + b = ☐ sentence 0-10 Score ___ M P N

B

name

Topic Inventory S3

Solve the number sentences.

$8-4=\boxed{4}$ $7-6=\boxed{2}$ $5-5=\boxed{0}$

$9-1=\boxed{8}$ $4-3=\boxed{1}$

Subtract.

$\begin{array}{r}5\\-2\\\hline 3\end{array}$ $\begin{array}{r}8\\-6\\\hline 2\end{array}$ $\begin{array}{r}6\\-3\\\hline 3\end{array}$ $\begin{array}{r}2\\-2\\\hline 0\end{array}$ $\begin{array}{r}9\\-3\\\hline 6\end{array}$

Obj. 2 solves a - b = ☐ sentence 0-10   Score ___   M   P   N

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3/79

Technical Report No. 522
Part 2 of 2 Parts

Development and Validation of Curriculum Units Related to Initial Sentence Writing

by
Vicky L. Kouba and
James M. Moser

Wisconsin Research
and Development Center
for Individualized Schooling

October 1979

Technical Report No. 522
Part 2 of 2 Parts

DEVELOPMENT AND VALIDATION OF CURRICULUM UNITS RELATED TO INITIAL SENTENCE WRITING

by

Vicky L. Kouba and James M. Moser

Technical Report No. 2 of
the Studies in Mathematics Series

Report from the Project on
Studies in Mathematics

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Wisconsin Research and Development Center
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Madison, Wisconsin

October 1979

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Center Grant No. OB-NIE-G-78-0217

MISSION STATEMENT

The mission of the Wisconsin Research and Development Center is to improve the quality of education by addressing the full range of issues and problems related to individualized schooling. Teaching, learning, and the problems of individualization are given concurrent attention in the Center's efforts to discover processes and develop strategies and materials for use in the schools. The Center pursues its mission by

- conducting and synthesizing research to clarify the processes of school-age children's learning and development
- conducting and synthesizing research to clarify effective approaches to teaching students basic skills and concepts
- developing and demonstrating improved instructional strategies, processes, and materials for students, teachers, and school administrators
- providing assistance to educators which helps transfer the outcomes of research and development to improved practice in local schools and teacher education institutions

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WISCONSIN RESEARCH AND DEVELOPMENT
CENTER FOR INDIVIDUALIZED SCHOOLING

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Abstract

This paper reports the formative evaluation of six curriculum units related to initial sentence writing. These units are used as the instructional units for a coordinated study carried out by the Mathematics Work Group of the Wisconsin Research and Development Center for Individualized Schooling. The units were tried during the 1977-78 and 1978-79 school years at a single elementary school located in Madison, Wisconsin.

Information, including in-class observation, reports from teachers, pupil assessment, and notes from pupil comments, was gathered from trying the materials on about 50 children through their first and second years of elementary school.

The information is summarized by topic or unit and suggested revisions are stated. Copies of the newly developed units are contained in the Appendix to the report.

APPENDIX D

TOPIC S-4: SOLVING SITUATIONS 0-20

TOPIC S4 SOLVING SITUATIONS 0-20

OBJECTIVES

Preparatory

1. Given an open sentence of the form $a + b = \square$ or $\begin{array}{r} a \\ \underline{+b} \end{array}$ involving the numbers 0-20, solves it. (solves $a + b = \square$ sentence 0-20).
2. Given an open sentence of the form $a - b = \square$ or $\begin{array}{r} a \\ \underline{-b} \end{array}$ involving the numbers 0 - 20, solves it. (solves $a - b = \square$ sentence 0-20).
3. Given an open situation involving the numbers 0-20 that is solvable by using either addition or subtraction, writes a sentence that represents that situation. (writes open + or - sentence 0-20).

OVERVIEW

This topic is the fourth in a series of six topics that have been called the Sentence Writing topics (S1 through S6). The major objective of this series of topics is to develop in first and second grade children the ability to solve problems in addition and subtraction that are reasonable for children of that particular age and state of development. The method for attainment of this major objective consists of two parts:

1. An analysis of the problem in terms of the relationships between the parts of the problem with the end result being the representation of these relationsips with either a horizontal or vertical number sentence of the form $a + b = \square$ $[\begin{array}{r} a \\ \underline{+b} \end{array}]$ or $a - b = \square$ $[\begin{array}{r} a \\ \underline{-b} \end{array}]$
2. The ability to solve the resulting mathematical sentence by any reasonable means, but preferably by recall of a basic addition or subtraction fact.

The underlying rationale for the analysis phase rests on what we have called the part-part-whole relationship. In this relationship one considers some whole object or set that can be broken up into two separate but distinct parts according to some identifiable rule or action or description. Assuming that numbers can be assigned to the whole and to its two component sub-parts, the analysis proceeds under these two numerical relationships:

i) If one knows the two parts, then add their corresponding numbers in order to find the size or number corresponding to the whole. Somewhat symbolically put, it is

part + part = whole

ii) If one knows one of the parts and the whole, then subtract the number corresponding to the part from the number corresponding to the whole to find the size or number corresponding to the other pat. Somewhat symbolically put, it is

whole - part = other part

Finally, the analysis phase comes to the crucial step of being able to take a particular given problem and decide whether the two known objects or sets are the two parts (in which case one adds) or are the whole and one of its parts (in which case one subtracts).

In the first paragraph reference was made to problems that are reasonable for first and second grade children. We consider a problem to be reasonable if its wording and structure are such that most children will be able to successfully subject the problem to the analysis described above.

The other major focus of the six-topic series is the acquisition of basic computational facts. In the earlier topics the majority of attention is given to the smaller-number, simpler facts with a progression building up to the harder facts. DMP does not assume that it has all the answers that will guarantee that all children will know all the facts by the end of these six topics. Individual variation in ability and rate of learning exists no matter what the program of instruction. The children you receive for this topic and this school year will be no different. You will have to adjust to those individual differences and supplement for some children. Spaced practice and drill are appropriate for almost all.

In the previous three sentence-writing topics the children have been presented with several different types of verbal problems. It was intended that they be straightforward, relatively simple situations with no difficult word order in a context that would be familiar to the children. These are the types the children have seen thus far:

Joining: There are 2 birds. 6 more come. How many birds are there now?

Separating: There are 8 frogs. 5 hop away. How many are left?

Part-Part-Whole There are 2 blue birds and 6 blackbirds. How many birds are there altogether? There are 8 frogs. 5 are big. The rest are little. How many little frogs are there?

Difference: There are 5 big frogs and 3 little frogs. How many more big frogs are there than little frogs? (How many fewer?) (What is the difference between...?)

After reading or hearing the problem situation the children have been asked to do one, two, or all three of the following as part of the analysis:

a. Fill in a part-part-whole chart with the information presented on the situation.

<table>
<tr><td colspan="2">whole</td></tr>
<tr><td>part</td><td>part</td></tr>
</table>

Example X	Example Y
2 birds	8 frogs
6 more come	5 hop away
How many now?	How many are left?

<table>
<tr><td colspan="2"></td></tr>
<tr><td>2</td><td>6</td></tr>
</table>

<table>
<tr><td colspan="2">8</td></tr>
<tr><td>5</td><td></td></tr>
</table>

b. Write a horizontal sentenc, a ± b = □ , based on the analysis and understanding of the following: Part + Part = Whole
Whole - Part = Part

Example X	Example Y
2 + 6 = □	8 - 5 = □

c. Write the sentence in vertical form.

$\begin{array}{r} a \\ \underline{+b} \end{array} \quad \begin{array}{r} p \\ \underline{+p} \end{array} \quad \begin{array}{r} w \\ \underline{-p} \end{array}$

Example X	Example Y
$\begin{array}{r} 2 \\ \underline{+6} \end{array}$	$\begin{array}{r} 8 \\ \underline{-5} \end{array}$

The children then solved by using objects, by counting, by "knowing" the number fact involved, or by assoicating the numbers involved with other facts. (4 + 3 = 7 because 3 + 3 = 6 and 1 more makes 7). By the end of Topic S3 mastery of basic fact combinations with sums up to 10 has been expected.

We are assuming that this present topic will be taught at the beginning of a new school year where an entire summer has intervened since the children's last experience with this type of thinking. Consequently the first two activities are basically review in nature (you may want to provide more of your own after going through these two activities!). The major difference is that the writing of horizontal sentences is by-passed at this time. The children go directly from the part-part-whole analysis chart to a vertical notation or to solving.

The third activity presents variations upon some familiar problem situations. In this activity, the unknown appears in a different position. If the problems were to appear in symbolic form, they would be described as "missing addend" or "missing subtrahend" problems. We give several examples.

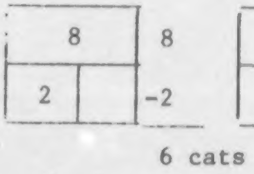
	In previous activities	Now, in Activity S3 - C
Joining	There were 6 cats. 2 more came. How many cats are there altogether?	Example Z: There were some cats. 2 more came. Then there were 8 cats. How many cats were there to start with? Example W: There were 4 cats. Some more came. Now there are 13. How many came?

Separating	There were 8 pigs. 3 went away. How many pigs were left?	Example V: There were some pigs. 3 went away. Then 5 pigs were left. How many pigs were there to start with?
Part-Part-Whole	There are 6 red hats and 2 white hats. How many hats are there altogether?	Example U: I have some red hats. I have 4 white hats. I have 12 red and white hats altogether. How many red hats do I have?
	There are 10 hats. 6 are red. The rest are white. How many hats are white?	Example T: There are 11 hats. Some are red. The rest are white. 5 are white. How many are red?

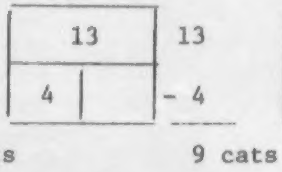
Although the variations are a bit more difficult and the situations less familiar, the intent is to have the children use the same part-part-whole analysis of identifying whether the two parts, or one part and the whole are given. The children should also know that when they are given the two parts and asked to find the whole, the operation to use is addition. When they are given the whole and one part and asked to find the other part, the operation to use is subtraction. (Regardless of the position of the unknown in the sentence.)

The analysis of Examples Z, W, V, U, and T would given the following part-part-whole charts and vertical sentences.

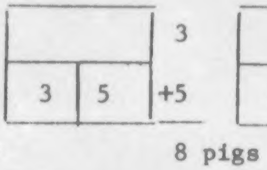
Example Z



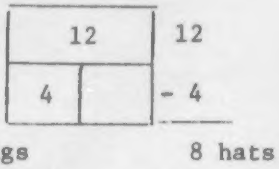
Example W



Example V



Example U



Example T

<table>
<tr><td colspan="2">11</td></tr>
<tr><td>5</td><td></td></tr>
</table>

$$\begin{array}{r} 11 \\ -\ 5 \\ \hline 6 \end{array}\ \text{hats}$$

In Activities D and E the children are asked to solve open sentences which may be described as the mathematical models of the problem types given in Activity C. These sentences are of the forms:

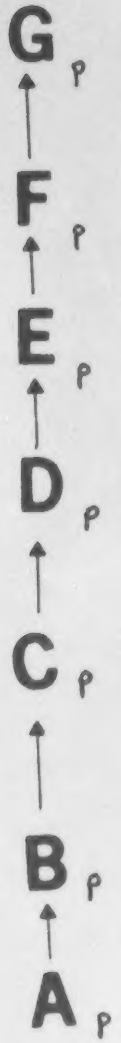
$a + \square = c \qquad \square + b = c \qquad a - \square = c \qquad \square - b = c$

Such sentences are known to be more difficult for children than those of the form $a + b = \square$ and $a - b = \square$. The reason for presentation of these other sentence forms is not to expect any mastery of solution of these types, but as a necessary and beneficial experience that helps the children to understand more fully the two sentence types ($p + p = w$ and $w - p = p$) and the application of the part-part-whole analysis to a given problem, verbal or symbolic.

In the first part of Activity D, when the children first are given the open sentences $a \pm \square = c$ and $\square \pm b = c$, they are asked to solve using any method or analysis. At this point, all methods attempted should be discussed. The teacher should not introduce or stress any particular method. Then, in the latter part of Activity D, the teacher presents and stresses the part-part-whole chart and analysis.

This topic also provides further practice with the addition/subtraction facts 0-20, with special emphasis on the 11-14 facts.

SEQUENCE OF ACTIVITIES


G p
F p
E p
D p
C p
B p
A p

ACTIVITY S4 A

In this activity the children are given joining and separating situations. For the first time, they do not write sentences. They solve using the part-part-whole analysis and chart, and write the problem in vertical form.

Objectives

1 solves $a + b = \square$ sentence 0-20

2 solves $a - b = \square$ sentence 0-20

3 writes open + or - sentence 0-20

Organization

large group

individuals

Materials

Student Booklet pages 2 and 3

objects (cubes, links)

Preparation

No special preparation.

Teaching Suggestions

In the previous sentence writing topics (S1, S2, S3) the children were given situations and asked to write and solve sentences. In this activity, as in all of this topic, they do not write sentences. Instead, for the first time, they use the part-part-whole chart exclusively to analyze. They record in vertical form ($\begin{array}{r}2\\ \underline{+6}\\ 8\end{array}$). Begin by reading and discussing the following story and problems.

THE MAGICIANS VISIT WHATVILLE

"The magicians are coming! The magicians are coming!" cried Peep from the edge of his birdbath.

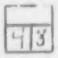
For days and days all the creatures in Whatville had been getting ready for the Magicians' Convention. They had cleaned and painted and decorated.

"How many magicians do you see?" asked Silly Sylvester. He stood on his tiptoes, trying to look down the road.

"Well, there are four in a strange looking car and eight more on bicycles. How many is that?" answered Peep.

"I think I'm going to need help to figure that out," mumbled Silly.

Pause here and have the children find how many magicians there are. Ask the children to dicide if Peep has told them two parts or the whole and one part. (Two parts) Ask if they have to find the whole or one part. (The whole) Ask what to do + or –. (+) Draw and fill in the chart:



Ask if the answer will be greater than or less than 8. Solve using objects or a counting strategy. Record in vertical form.

$$\begin{array}{r}4\\ \underline{+\ 8}\\ 12\end{array}$$

"Twelve magicians altogether. That's a lot of magicians for Whatville. And just look at that car!" exclaimed Franny. "It's the orangest orange I've ever seen."

"But it's not orange," argued Goofy. "It's green!"

And sure enough, when Franny looked again, the car was green.

"Well, it was orange. It really was," said Franny.

"You're both wrong!" cried Peep. "It's a pink car." They all looked again and the car was PINK!

"Hey," shouted Silly, "You're all right. First the car was orange, then green, and now pink. It changes colors."

"Of course," laughed Peep. "What do you expect? It's a magician's car and a magician's car has to be magic."

"It certainly has lots of wheels," said Silly, pointing to the car again, which had now turned a very bright purple. "I count fifteen wheels."

"Whoops!" moaned Franny. "There it goes again, being magic. Nine of the wheels disappeared!"

"How many are left?" asked Silly.

Pause here and have the children find how many are left. Ask what information is given. (the whole and a part) Draw and fill in the chart:

<table>
<tr><td colspan="2">15</td></tr>
<tr><td>9</td><td></td></tr>
</table>

Remind the children that when they know the whole and one part, they subtract to find the other part. Ask if the answer will be greater than or less than 15. Solve with objects or counting. Record using the vertical form.

$$\begin{array}{r} 15 \\ -\ \ 9 \\ \hline 6 \end{array}$$

By now all the magicians had gone past and were arriving at the Whatville Hotel, where Martin the Munch and Gertrude the Gobble were busy handing out glasses of lemonade and little cakes that Martin had baked.

"Terrific! Terrific!" shouted Peep as he hopped high into the air so that he could see the Whatville Hotel better.

Then . . . KERSPLASH . . . he landed right in the middle of his bath, splashing water all over everyone.

"Whoops," said Peep in a small voice. "I'm sorry. I was so excited about the convention and all the amazing things we're going to see that I forgot to watch where I was hopping."

"That's okay," said Silly. "Just dry off and let's go to the convention. I bet I can make Martin's cakes disappear."

Everyone laughed and agreed that they, too, could make some cakes disappear.

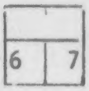
Read and discuss the following problems with the children. Have them use the part-part-whole chart to help them analyze the problems. Use the vertical form to record.

1. Martin baked 6 purple cakes.
   Franny baked 7 yellow cakes.
   How many cakes altogether?

Guide their thinking in this manner:

What do we know from reading the story? (two parts)

What do we need to find? (the whole)



Do we add or subtract? (+)

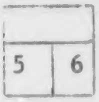
Solve the problem this way.

$$\begin{array}{r} 6 \\ +\ 7 \\ \hline 13 \end{array}$$

2. 5 magicians on bicycles.

6 magicians in a go-cart.

How many magicians altogether?

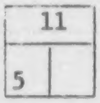


$$\begin{array}{r} 5 \\ +\ 6 \\ \hline 11 \end{array}$$

3. 11 doors on the magician's car.

5 disappeared.

How many doors are left?

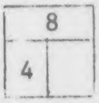


$$\begin{array}{r} 11 \\ -\ 5 \\ \hline 6 \end{array}$$

4. 8 flowers on Goofy's hat.

4 disappeared.

How many flowers left?

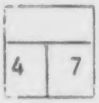


$$\begin{array}{r} 8 \\ -\ 4 \\ \hline 4 \end{array}$$

5. 4 magicians in black coats.

7 magicians in long dresses.

How many magicians altogether?

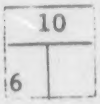


$$\begin{array}{r} 4 \\ +\ 7 \\ \hline 11 \end{array}$$

6. 10 birds in the magician's basket.

6 flew away.

How many bird's are left?



$$\begin{array}{r} 10 \\ -\ 6 \\ \hline 4 \end{array}$$

Do as many more examples as you think are necessary. Then let the children do Student Booklet page 2 and 3, which give several "magician" stories to solve. When they have completed the pages, discuss their answers. Point out that the whole is always the biggest number of the three numbers in a problem.

ACTIVITY S4 B

This activity uses weight and length situations to reinforce the part-part-whole analysis.

Objectives

1 solves $a + b = \square$ sentence 0-20

2 solves $a - b = \square$ sentence 0-20

3 writes open + or - sentence 0-20

Organization

large group (Parts 1 and 2)

individual (Part 1)

Materials

Student Booklet pages 4 and 5 (Part 1)

Cubes (Part 1)

Scissors (Part 1)

Balance (Part 2, optional)

Containers with lid (Part 2, optional)

Geometric solids (Part 2, optional)

Small washers (Part 2, optional)

Bathroom scale (Part 2, optional)

Large objects, over 5 pounds (Part 2, optional)

Preparation

Part 1: Carefully remove student booklet pages 4 and 5 from the booklets.

Part 2: Place two similar geometric solids in a covered container.

Find the total weight of container and solids using small washers. Place container, balance, and a number of washers three fewer than the total weight of the container and solids, at a location in your room that is visible to all children.

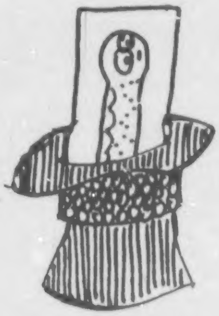
Prepare other similar containers.

Teaching Suggestions

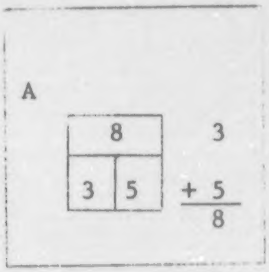
In this activity the children analyze length and weight situations using the idea of P + P = W and W - P = P. Part 1 presents length situations. Part 2 presents a large group demonstration and discussion involving weight.

Part 1. Give each child Student Booklet pages 4 and 5. Have them carefully cut apart the worm strips on page 4. Also have them carefully cut the slit in the magic hat on page 5.

Next have each child take worm A and place it through the magic hat slit so that part of the worm is in the hat (hidden under page) and part is out of the hat.

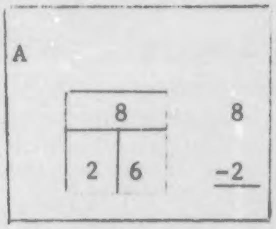


Ask what the children could do to find the whole length of the worm in cubes if they can't take it out of the hat. Explain that to find the whole they have to know both parts. Have them measure (with cubes) the part of the worm sticking out of the hat. Then have them turn over the page, being careful not to move the worm, and measure the "hidden" part. Enter these parts in the part-part-whole chart for worm A at the top of page 8. Then solve to find the whole. For example:



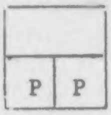
Have the children do the same for worms B, C, D, E, F, G, H, and J.

When all the children have finished, explain that this time they are going to find how long the hidden part is. To find a missing part they must know the whole and one part. Have them measure the length of worm A and record in the part-whole chart for worm A at the bottom of page 8. Then have them place worm A "in the hat." Explain that this time they cannot turn the page over. The only part they are able to measure is the part showing (the part sticking out of the hat). Have them measure using cubes, and record in the part-whole chart for worm A at the bottom of page 8. Then solve to "magically" find the length of the hidden part. For example:



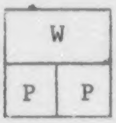
Have the children do the same for worm B, C, D, E, F, G, H, and J.

When the children have finished, discuss what they have done: They worked with two kinds of situations. In one situation they used the two parts to find the whole. Draw the following on the board. If you know the two parts, you ADD to find the whole.



$$\begin{array}{r} P \\ \underline{+P} \end{array} \qquad P + P = \square$$

In each, the answer is the whole. In the other situation they used the whole and a part to find the missing part. When you know the whole and one part, you take the part you know away from the whole (subtract) and that leaves the missing part. Write the following on the board.



$$\begin{array}{r} W \\ \underline{-P} \end{array} \qquad W - P = \square$$

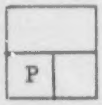
The answer is the missing part.

So, there are two kinds of sentences, one with a + sign and one with a - sign.

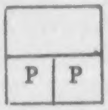
Part 2. This part uses a large group discussion of problems involving weighing to present the part-part-whole analysis.

Begin by asking someone to come up and find the weight of the container. Use small washers as weights. As the child does the weighing, he or she will discover that there are not enough washers. Discuss what could be done. If some children suggest getting more washers, agree that that would be one solution; but ask what could be done if there were no more washers. If some children suggest using a different unit of weight, explain that you want to know the weight in washers (and nothing else).

If no one suggests it, suggest seeing if you could weigh two parts. Ask how that would tell you the weight of the whole thing. (P + P = W) Open the container and take out one of the solids. Have someone weigh the container and the solid left. Record the weight in a p-p-w chart.



Then weigh the solid you took out. Records its weight in the chart.



Have someone write and solve the sentence that would show how to find the whole. $P + P = \boxed{W}$

Next ask if the children can think of any times in daily life when two parts are weighed and then added to find the whole. For example--the weight of people on an elevator, the weight of a car and trailer.

Next discuss how the children could find the weight of a pet. (Assume the animal is uncooperative about standing on a scale.) If no one suggests it, then you explain that you could weigh yourself and then hold the pet and weigh yourself and the pet. Then you would know the whole (self and pet) and one part (self). You could subtract to find the weight of the pet (the other part). W - P = P

Ask if the children can think of any other examples of using the weights of the whole and one part to find the other part. Then do one of the following:

A. Use a bathroom scale. Have children find the weight of a large object or box of objects, by using W - P = P. They weigh themselves while holding the object. Then they weigh themselves without the object. You may have to help them read the scale. Have them tell you what sentence to write, how to fill in the part-part-whole chart; then you solve, as the numbers will be too large for the children to do the computing.

B. Prepare the containers as in the discussion. Have the children weigh two parts to find the whole. Use small washers as units of weight.

ACTIVITY S4 G

In this activity the children are given situations that may be represented by the open sentences $a \pm \square = c$, $a \pm b = \square$, and $\square \pm b = c$. The children are not asked to write sentences; they use the part-part-whole chart to analyze and solve.

Objectives

1 solves $a + b = \square$ sentence 0-20

2 solves $a - b = \square$ sentence 0-20

3 writes open + or - sentence 0-20

Organization

large group (Part 1)

individual (Part 2)

Materials

Student Booklet pages 6-11 (Part 2)

Objects (Parts 1 and 2)

Preparation

No special preparation.

Teaching Suggestions

In Topic S3 the children had some experience with situations in which the word order was unfamiliar and with situations involving a missing addend. They were encouraged to use the part-part-whole chart to analyze the situations, to write sentences ($a \pm b = \square$), and to solve.

In this activity the children are asked to solve similar problems, but they do not write sentences. They use the part-part-whole chart to analyze and record in the vertical compact form. $\begin{array}{r}2\\ \underline{(+6)}\\ 8\end{array}$

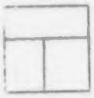
Part 1. Begin by discussing the following problems. Stress that the WHOLE is the largest number. Use objects to dramatize each story as you read it, or draw pictures on the board.

1. There are six rabbits in the hat. (Show 6 objects.)

   Some more come.

   Now there are thirteen rabbits in the hat. (Show 13 objects.)

   How many rabbits came?

(Draw the chart:  . Ask what information the story gives: one part and the whole. Have a child fill in the chart:

<table>
<tr><td colspan="2">13</td></tr>
<tr><td>6</td><td></td></tr>
</table>

Ask what to do to find the other part: subtract. Write $\begin{array}{r}13\\ \underline{-\ 6}\end{array}$. Solve using objects, counting, or whatever method the children choose. Once the answer is determined, validate with objects.)

Do the following stories in the same way. Remember to use objects.

2. There are 11 tigers.

   Some disappear. POOF!

   There are 4 left.

   How many disappeared?

<table>
<tr><td colspan="2">11</td></tr>
<tr><td>4</td><td></td></tr>
</table>

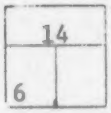
$\begin{array}{r}11\\ \underline{-\ \ 4}\\ 7\end{array}$

3. There are some red balls.

6 more balls appear. POOF!

Now there are 14 balls.

How many balls were there to start with?

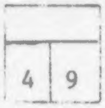


$$\begin{array}{r}14\\-\ 6\\\hline\end{array}$$

4. There are 4 mice.

9 more appear. POOF!

How many are there now?



$$\begin{array}{r}4\\+9\\\hline 13\end{array}$$

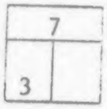
Part 2. Next have the children do student booklet pages 6-11. They should read each problem and decide if the problem gives them two parts or a whole and one part. You may want them to label the numbers in each problem with P or W, as shown in the first problem on page 6. They fill in those two numbers on the chart and add or subtract in vertical compact form. $\begin{array}{r}2\\(+3)\\\hline 5\end{array}$ They may use objects to help solve.

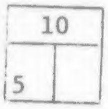
You may also wish to discuss the words "appear" and "disappear."

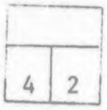
As the children do the pages have them "plug" their answers back into the situation to see if their answer is reasonable.

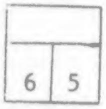
Additional Suggestion

Give the children the following charts and have them write their own stories.









ACTIVITY S4 D

In this activity the children are given open sentences of the form $a \pm \square = c$, $\square \pm b = c$, and $a \pm b = \square$ and asked to solve, at first with no specific directions and then by using the part-part-whole chart.

Objectives

1. solves $a + b = \square$ sentence 0-20
2. solves $a - b = \square$ sentence 0-20
3. writes open + or - sentence 0-20

Organization

large group

individual

Materials

Student Booklet pages 12 and 13 (part 1)

Student Booklet page 14 (part 2)

Student Booklet pages 15 and 16 (part 3)

Objects for solving (all parts)

Preparation

No special preparation.

Teaching suggestions

The children begin in part 1 by reviewing solving sentences of the form $a \pm b = \square$. Then, for the first time, the children are given open sentences of the form $a \pm \square = c$ and $\square \pm b = c$ (as well as the more familiar $a \pm b = \square$) and are asked to solve. In part 2 they solve with any analysis or method they choose. In part 3, they are asked to use the part-part-whole analysis. Once the children have filled in the chart ( ), they may use their own system for solving: counting, using objects, using fingers, using pictures or whatever. As they solve, ask how they got their answers. Encourage them to rely more on their memory and understanding of the number facts. Also ask them to validate by explaining answers or by using objects.

Part 1. This part reviews solving sentences familiar to the children. Begin by writing the two part-part-whole sentences on the board.

$$\text{part} + \text{part} = \boxed{\phantom{\text{whole}}}$$
$$\text{whole} - \text{part} = \boxed{\phantom{\text{whole}}}$$

For each ask the children what the box means. (That that bit of information is unknown.) For each ask what is unknown and fill it in. Then write the vertical notation.

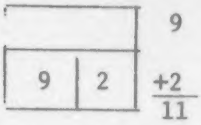
$$\text{part} + \text{part} = \boxed{\text{whole}} \qquad \begin{array}{r} \text{part} \\ +\ \text{part} \\ \hline \text{whole} \end{array}$$

$$\text{whole} - \text{part} = \boxed{\text{part}} \qquad \begin{array}{r} \text{whole} \\ -\ \text{part} \\ \hline \text{part} \end{array}$$

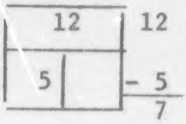
Point out that there are only two types of sentences, the addition one and the subtraction one. Then have volunteers solve the following sentences.

Label the whole and the part in each.

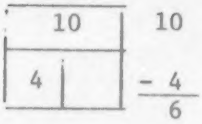
$9 + 2 = \square$
p p w



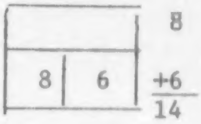
$12 - 5 = \square$
w p p



$10 - 4 = \square$
w p p



$8 + 6 = \square$
p p w



Next have the children solve the sentences on Student Booklet pages 12 and 13. Have the children label the whole (w) and the parts (p), fill in the chart, write the vertical form and solve.

Part 2. Begin by giving the children Student Booklet page 14. Since this is the first time the children see open sentences of forms other than $a \pm b = \square$, they may be uncertain about what to do. Do not demonstrate how to solve or encourage any particular method of analysis. Explain that the sentences are a puzzle. The children are to find what number goes in each "mystery box" to make each sentence true. Tell them that they may solve any way they like, but that they should remember what they did, so that they are able to explain their method to the rest of the class.

If any children seem totally confused or discouraged, encourage them to work in small groups to see if they can help each other decide what to do.

When the children finish the page, discuss all of the methods they used. Do this by having volunteers tell what answers they got and by showing how they got them. Have them pretend they are teaching the rest of the class.

At this time you may also discuss the reasonableness of answers. For example, with $7 - \square = 6$, you can ask if the number in the box could be greater than 7? greater than 6?

Part 3. Remind the children of the mystery sentences they solved in Part 1. Tell them that you are going to show them a way to solve those sentences using what they already know about sentences and about the whoel and two parts.

Draw the part-whole chart on the board and have the children fill in the appropriate words.

<table>
<tr><td colspan="2">WHOLE</td></tr>
<tr><td>PART</td><td>PART</td></tr>
</table>

Explain that so far they know two kinds of sentences.

$p + p = w$ Write these on the board.

$w - p = p$

Then write these sentences on the board:

$4 + 2 = \square$ $4 + \square = 9$ $\square + 2 = 5$

$7 - 2 = \square$ $8 - \square = 5$ $\square - 3 = 7$

Analyze each in the following way. (After the first couple let the children label the parts and fill in the chart.)

Look at the sentence $4 + \square = 9$

Is the sentence $p + p = w$ or $w - p = p$? ($p + p = w$)

Label the parts and the whole.

$4 + \square = 9$

p p w

What's missing? (a part)

Fill in the chart and solve.

9	
4	

9	
4	5

The children may solve using their knowledge of number facts, using objects, counting, or using whatever method they feel comfortable with. Next have the children do Student Booklet pages 15 and 16. Encourage them to use the part-part-whole chart. When all the children have finished, review solving using the part-part-whole chart as described above.

ACTIVITY S4 E

In this activity the children practice solving open sentences.

Objectives

1 solves a + b = □ sentence 0-20

2 solves a + b = □ sentence 0-20

3 writes open + or - sentence 0-20

Organization

Individual

Materials

Student Booklet pages 17-21

objects

Preparation

No special preparation

Teaching Suggestions

Begin by reviewing how to solve open sentences using the part-part-whole chart to analyze. Solve with objects, by remembering, by counting, or by using tally marks.

For example:

$3 + \square = 11$

$\underset{P}{3} + \underset{P}{\square} = \underset{W}{11}$

$3 + 8 = 11$

It's a P + P = W sentence

<table>
<tr><td colspan="2">11</td></tr>
<tr><td>3</td><td></td></tr>
</table>

Do the following sentences in the same way.

$12 - \square = 3$ $\quad\quad$ $\square + 5 = 11$

$4 + 8 = \square$ $\quad\quad$ $15 - 9 = \square$ $\quad\quad$ $\square - 6 = 4$

The children do Student Booklet pages 17-21. They may solve using objects, number facts, or counting strategies. Student Booklet page 17. The children solve open sentences. The chart is drawn for them.

Student Booklet page 18. The children solve 16 sentences. The correct answers are written at the bottom of the page. The children match the letter name of the problem to the right solution. They get jumbled letters and must unjumble the letters to spell words. The letters may be used more than once.

Student Booklet page 19. The children choose and circle the correct answer, if it is there. No correct answer is given for problems 3, 5, and 7. You may have the children write in the correct answer.

Student Booklet pages 20 and 21. Solutions are given to open sentences. The children must decide whether each solution makes the sentence true or false, and then correct any false answers.

ACTIVITY S4 F

This activity provides games and puzzles to practice addition and subtraction (0-20, particularly with the facts having sums 9-14).

Objectives

1 solves $a + b = \square$ sentence 0-20

2 solves $a - b = \square$ sentence 0-20

3 writes open + or - sentence 0-20

Organization

small group

individual

Materials

Student Booklet pages 22 and 23

paper and pencil

straight edge

chips

dice

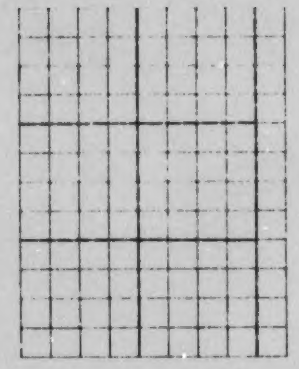
links

graph paper

Preparation

Have the children make the necessary strips or grids for This and More.

Use the 2-centimeter graph paper duplicating master to make a sheet for each child. From the graph paper, cut four or five 4 x 4 grids for each child. You can get six grids from each piece of paper.



Make a list of open sentences with solutions equaling 0-14.

Teaching Suggestions

This activity presents two games and two puzzle pages that provide practice with the addition and subtraction facts. The sentence Bingo game may be played with the class as a group. The This and More game and the pages may be used by small groups and individuals.

Sentence Bingo

The children play bingo to practice representing and solving open sentences. Give each child three or four cut-out grids and have him write the numbers 0-14 in the squares in random order until all of them are filled.

Use your prepared list of sentences. Write an open sentence on the board. Each child solves the sentence and colors a square on his grid that has the solution. Continue until one child gets four in a row. He wins that round. Have the children use a new grid for each round.

This and More. (need pencil, paper, two dice, and chips) Have each child make the following strip of paper.

3	5	6	7	8	9	10

On your turn roll the two dice. Add the two numbers to get a total. Then decide how many more you would need to have 14. Put a chip over that number on your strip, if it's there.

The winner is the first person to cover all the numbers on the strip.

Variations

A. Make and use this grid instead of a strip.

2	3	4	5
9	8	7	6
10	11	12	2
3	4	5	6

First person to cover 4 in a row or four in a square is the winner.

3	4
8	7

B. Make the number you have to get be 12 or 13 instead of 14.

The scoring strips and grids the children need to make would be

for 13

3	4	5	6	7	8	9

1	2	3	4
8	7	6	5
9	10	11	1
2	3	4	5

for 12

2	4	5	6	7	8

0	1	2	3
7	6	5	4
8	0	10	11
2	1	0	12

Student Booklet page 22. The children solve 16 problems. When they have finished, for each puzzle have the children connect the dots (using a straight edge) in order from the smallest answer to the largest.

Student Booklet page 23. For each puzzle, the children solve the problems and then write all the numbers that come in order between the two answers.

ACTIVITY S4 G

The children practice addition and subtraction facts 0-20, especially those with sums 0-14. They also explore number patterns and relationships introduced in Topics S2 and S3.

Objectives

1 solves $a + b = \square$ sentence 0-20.
2 solves $a - b = \square$ sentence 0-20.
3 write open + or - sentence 0-20

Organization

individual (Parts 1 and 2)
group (Part 2)

Materials

Student Booklet pages 24 and 25 (Part 1)
Student Booklet pages 26-29 (Part 2)
Objects for solving or validating (Parts 1 and 2)

Preparation

No special preparation.

Teaching Suggestions

In Part 1 of this activity the children use addition and subtraction to answer questions about information presented on maps and graphs. In Part 2 the child explores number patterns and relationships as well as practice the addition and subtraction facts. Throughout this activity ask the children to validate by counting, drawing tally marks or using objects.

Part 1. Student Booklet page 24 asks the children to find the sum of two numbers from a map. The children should be reminded to use the compact form $\left(\begin{array}{r}3\\ \underline{+7}\end{array}\right)$ for each problem. Do the first problem with the children to make sure they understand what they are to do.

Student Booklet page 25 asks the children to find differences and sums using information given on a bar graph. Have the children write an open sentence and then solve using memory of facts, counting, or objects.

Part 2. These pages explore number patterns and relationships. Have the children do the pages, then discuss the patterns and relationships described below.

Student Booklet page 26 . In row A the pattern is that a number is added to itself. All the answers are even numbers. In row B the relationship is one-more and one-less. You may wish to extend this. "What is one more than 12? One less than 12? One more than 7? One less than 7?" You may wish to combine the relationships in rows A and B. For example:

If 6 + 6 = 12, 6 + 7 is one more or 13.

If 4 + 4 = 8, 4 + 3 is one less or 7.

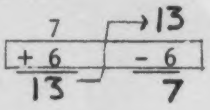
In row C the subtraction problems are the inverse of row A. You may wish to have the children match. Matching problems are related because they have the same part-part-whole chart.

For example:

$$\begin{array}{r} 7 \\ +\ 7 \\ \hline \enclose{circle}{14} \end{array} \qquad \begin{array}{|c|c|} \hline \multicolumn{2}{|c|}{\enclose{circle}{14}} \\ \hline 7 & 7 \\ \hline \end{array} \qquad \text{and} \qquad \begin{array}{r} 14 \\ -\ 7 \\ \hline \enclose{circle}{7} \end{array} \qquad \begin{array}{|c|c|} \hline \multicolumn{2}{|c|}{14} \\ \hline 7 & \enclose{circle}{7} \\ \hline \end{array}$$

In row D the answers alternate 11, 12, 11, 12, 11, 12. In row E the pattern of adding 9 is explored. You may choose to discuss this as a one-less relationship. (9 + 5 is one less than 10 + 5, therefore 9 + 5 = 14.)

Student Booklet page 27. The children do "snake" addition and subtraction. The number that is added (subtracted) in the first step is then subtracted (added) in pieces in the next two steps. Seeing this relationship may be challenging for the children. If so, put the following problems on the board.



Point to these and ask what is happening. (The same number is added and then taken away, so the number started with, 7, isn't changed.)

Student Booklet page 28. Three types of number relationships are mixed on this page. In some pairs, commutativity of addition is demonstrated, as in 1 + 13 = $\boxed{14}$ and 13 + 1 = $\boxed{14}$. In some pairs, the relationship between the whole and the two parts is demonstrated. That is, that the Whole - Part = the other Part and Whole - the other Part = Part. For example, 11 - 3 = $\boxed{8}$ and 11 - 8 = $\boxed{3}$. In other pairs, the relationship demonstrated on student booklet page 27 is shown in simpler form. That is, that if to add and then subtract (or subtract then add) the same number, you will end with the other number that you started with. For example:

$\boxed{14} - 2 = 12$

$12 + 2 = \boxed{14}$

same

Some pairs also look at addition and subtraction of 0 or 1.

Student Booklet page 29. This page reviews number families. In each house is a family of problems. They are a family because the part-part-whole chart is the same for each problem in the family. For example:

For $\begin{array}{r} 7 \\ +\,4 \\ \hline \end{array}$ $\begin{array}{r} 11 \\ -\,4 \\ \hline \end{array}$ $\begin{array}{r} 11 \\ -\,7 \\ \hline \end{array}$ $\begin{array}{r} 4 \\ +7 \\ \hline \end{array}$ the chart is $\begin{array}{|c|c|} \hline \multicolumn{2}{|c|}{11} \\ \hline 7 & 4 \\ \hline \end{array}$

For those children who are still having difficulty, explain that the whole is the name of the family. It tells how many boys and girls altogether in a family. One part tells how many boys. The other part tells how many girls. In each house or family, then, the number of boys and the number of girls doesn't change. The whole and the parts are constant.

For example; for $\begin{array}{|c|c|} \hline \multicolumn{2}{|c|}{11} \\ \hline 7 & 4 \\ \hline \end{array}$ you couldn't write $\begin{array}{r} 10 \\ +\,1 \\ \hline 11 \end{array}$ as a part of that family. It tells about 10 boys and 1 girl, not 7 boys and 4 girls. You may wish to do some examples with the children's families.

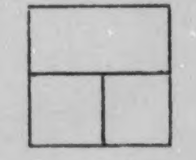
Topic S4
Topic Inventory
Teacher Directions

If the children have difficulty reading the problems, read the problems aloud as a group.

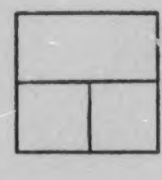
Remind the children that for this topic inventory they do not write the sentence. They fill in the part-part-whole chart and solve, writing the problem in the vertical form.

Find the answer for each story.
Use the chart to help.

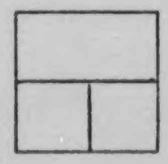
1. 3 blue cars
6 red cars
How many cars altogether?



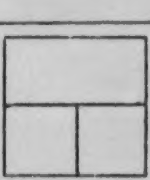
2. 8 cars altogether.
2 are green.
The rest are white.
How many cars are white?



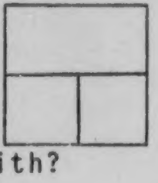
3. There are 12 cars.
Some go away.
4 are left.
How many went away?



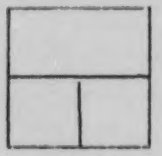
4. There are some cars.
5 go away.
6 are left.
How many cars were there to start with?



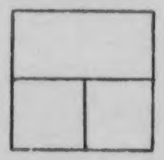
5. There are some cars.
3 more come.
Now there are 9 cars.
How many were there to start with?



6. There are 7 cars.
Some more cars come.
Now there are 11 cars.
How many cars came?



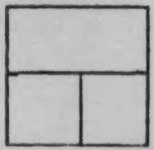
7. There were 5 cars.
7 more came.
How many cars are there now?



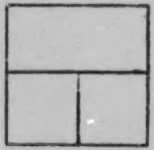
B

Topic Inventory S4 page B

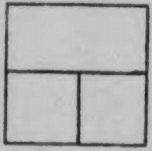
8. There are some red and yellow cars.
6 are red.
4 are yellow.
How many red and yellow cars are there altogether?



9. There were 13 cars.
7 went away.
How many are left?



10. There were 13 cars.
Some went away.
5 are left.
How many went away?



Add.

7	6	2	0	4
+ 3	+ 6	+ 9	+ 7	+ 8

Subtract.

14	10	11	8	9
- 7	- 2	- 3	- 4	- 0

TWELVE TRICKS

Find the answer. Use the chart and up and down notation.

1. 12 magicians
4 more come
How many now?

<table><tr><td colspan="2"></td></tr><tr><td>12</td><td>4</td></tr></table>

$$\begin{array}{r} 12 \\ +\ 4 \\ \hline 16 \end{array}$$

3. 9 balls
5 disappear
How many now?

<table><tr><td colspan="2">9</td></tr><tr><td>5</td><td></td></tr></table>

$$\begin{array}{r} 9 \\ -\ 5 \\ \hline 4 \end{array}$$

4. 8 birds
5 more come
How many now?

<table><tr><td colspan="2"></td></tr><tr><td>8</td><td>5</td></tr></table>

$$\begin{array}{r} 8 \\ +\ 5 \\ \hline 13 \end{array}$$

6. 12 cats
8 go away
How many now?

<table><tr><td colspan="2">12</td></tr><tr><td>8</td><td></td></tr></table>

$$\begin{array}{r} 12 \\ -\ 8 \\ \hline 4 \end{array}$$

7. 11 coats
2 disappear
How many now?

<table><tr><td colspan="2">11</td></tr><tr><td>2</td><td></td></tr></table>

$$\begin{array}{r} 11 \\ -\ 2 \\ \hline 9 \end{array}$$

9. 6 red balls
6 more come
How many now?

<table><tr><td colspan="2"></td></tr><tr><td>6</td><td>6</td></tr></table>

$$\begin{array}{r} 6 \\ +\ 6 \\ \hline 12 \end{array}$$

10. 10 cards
1 disappears
How many now?

<table><tr><td colspan="2">10</td></tr><tr><td>1</td><td></td></tr></table>

$$\begin{array}{r} 10 \\ -\ 1 \\ \hline 9 \end{array}$$

12. 3 doves
7 more come
How many now?

<table><tr><td colspan="2"></td></tr><tr><td>3</td><td>7</td></tr></table>

$$\begin{array}{r} 3 \\ +\ 7 \\ \hline 10 \end{array}$$

2. 6 flowers
3 more come
How many now?

<table><tr><td colspan="2"></td></tr><tr><td>6</td><td>3</td></tr></table>

$$\begin{array}{r} 6 \\ +3 \\ \hline 9 \end{array}$$

5. 13 hats
7 go away
How many now?

<table><tr><td colspan="2">13</td></tr><tr><td>7</td><td></td></tr></table>

$$\begin{array}{r} 13 \\ -\ 7 \\ \hline 6 \end{array}$$

8. 4 rabbits
4 more come
How many now?

<table><tr><td colspan="2"></td></tr><tr><td>4</td><td>4</td></tr></table>

$$\begin{array}{r} 4 \\ +\ 4 \\ \hline 8 \end{array}$$

11. 7 blue balls
4 go away
How many now?

<table><tr><td colspan="2">7</td></tr><tr><td>4</td><td></td></tr></table>

$$\begin{array}{r} 7 \\ -\ 4 \\ \hline 3 \end{array}$$

POOF + POOF- 3

Find the answer. Use the chart and up-and-down form.

1. 10

7 go away

10	
7	

10
− 7
3

2. 5

4 go away

5	
4	

5
− 4
1

3. 3

6 more come

3	6

3
+ 6
9

4. 7

5 more come

7	5

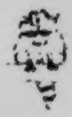
7
+ 5
12

5. 9

4 more come

9	4

9
+ 4
13

6. 11 

9 go away

11	
9	

11
− 9
2

7. 8

2 go away

8	
2	

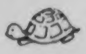
8
− 2
6

8. 2

8 more come

2	8

2
+ 8
10

9. 1 

9 more come

1	9

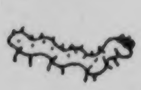
1
+ 9
10

10. 6

3 go away

6	
3	

6
− 3
3

11. 14 

6 go away

14	
6	

14
− 6
8

12. 8

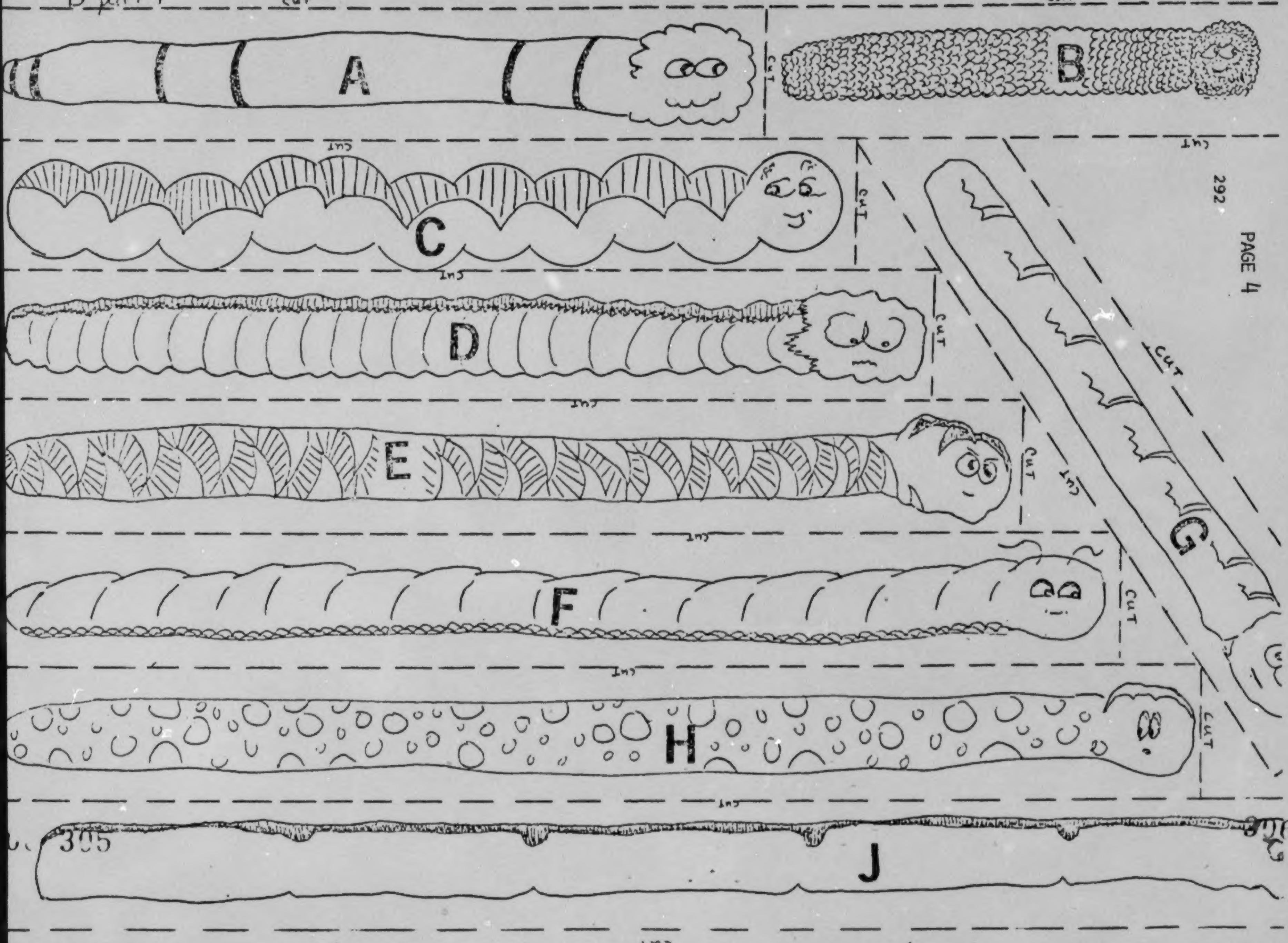
3 more come

8	3

8
+ 3
11

A

B part 1


CUT
A
B
C
D
E
F
G
H
J

Follow the directions your teacher gives. answers vary 5

A

B

C

D

E

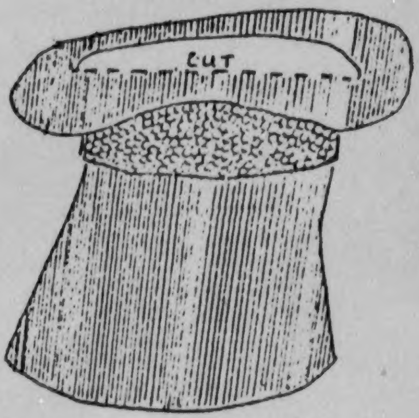
F

G

H

J

AND NOW ...
MY GREAT AND
PUZZLING...
WORM
TRICKS!



A

B

C

D

E

F

G

H

J

B part 1

Find the answers. Use the charts.

1. There were 4 fat cats. p
Some more came.
Now there are 13. w
How many came?

13	
4	

$\begin{array}{r}13\\-\ 4\\\hline\end{array}$

2. There were some tan cans.
6 more came. p
Now there are 9 tan cans. w
How many were there to start with?

9	
6	

$\begin{array}{r}9\\-6\\\hline 3\end{array}$

3. There were 8 hot pots.
p 3 more came. p
How many are there altogether?

8	3

$\begin{array}{r}8\\+3\\\hline 11\end{array}$

4. There were 11 tall dolls. w
Some went away.
Now there are 2 left. p
How many went away?

11	
2	

$\begin{array}{r}11\\-\ 2\\\hline 9\end{array}$

5. There were some wet pets.
5 more came.
Now there are 12. W
How many came?

12	
5	

$\begin{array}{r}12\\-\ 5\\\hline 7\end{array}$

6. There were 6 fat rats. p
Some more came.
Now there are 12. W
How many came?

12	
6	

$\begin{array}{r}12\\-\ 6\\\hline 6\end{array}$

C part 2

THE MAGIC COINS

FIND THE ANSWER. USE THE CHART TO HELP.

1. Franny has 14 W pennies.
POOF Some disappear.
She has 8 P pennies left.
How many pennies disappeared?

14	
8	

$$\begin{array}{r}14\\-8\\\hline 6\end{array}$$

2. Goofy has some pennies.
POOF 7 P more pennies appear.
Now he has 12 W pennies.
How many pennies did he have to start with?

12	
7	

$$\begin{array}{r}12\\-7\\\hline 5\end{array}$$

3. Silly has 8 P pennies.
POOF 8 P more pennies appear.
How many pennies does he
have altogether?

8	8

$$\begin{array}{r}8\\+8\\\hline 16\end{array}$$

4. Martin has 10 W pennies.
POOF Some pennies disappear.
Now he has 2 P pennies.
How many disappeared?

10	
2	

$$\begin{array}{r}10\\-2\\\hline 8\end{array}$$

5. Gertrude has 7 P pennies.
POOF Some more appear.
Now she has 11 W pennies.
How many pennies appeared?

11	
7	

$$\begin{array}{r}11\\-7\\\hline 4\end{array}$$

6. Nutty has some pennies.
POOF 5 P more pennies appear.
Now he has 8 W pennies.
How many pennies did he have to start with?

8	
5	

$$\begin{array}{r}8\\-5\\\hline 3\end{array}$$

C part 2

7. Peep has 14 W pennies.
POOF Some disappear.
He has 5 P pennies left.
How many pennies disappeared?

14	
5	

$$\begin{array}{r}14\\-5\\\hline 9\end{array}$$

CARS AND COLORS

8

Find the answer. Use the chart to help.

1. P ⑥ red cars
Some more come.
W ⑫ red cars now
How many came?

12	
6	

$$\begin{array}{r}12\\-6\\\hline 6\end{array}$$

2. i ⑧ green cars
P ⑤ more come.
How many altogether?

8	5

$$\begin{array}{r}8\\+5\\\hline 13\end{array}$$

3. W ⑬ white cars
Some go away.
P ⑤ are left.
How many went away?

13	
5	

$$\begin{array}{r}13\\-5\\\hline 8\end{array}$$

4. W ⑧ blue cars
Some go away.
There are ⑤ P left.
How many went away?

8	
5	

$$\begin{array}{r}8\\-5\\\hline 3\end{array}$$

5. P ⑨ tan cars
Some more come.
Now there are ⑫. W
How many came?

12	
9	

$$\begin{array}{r}12\\-9\\\hline 3\end{array}$$

6. Some black cars
P ⑥ more come.
Now there are ⑨. W
How many were there
to start with?

9	
6	

$$\begin{array}{r}9\\-6\\\hline 3\end{array}$$

C part 2

7. i ⑦ orange cars
P ⑦ more come.
How many altogether?

7	7

$$\begin{array}{r}7\\+7\\\hline 14\end{array}$$

FIND THE ANSWERS. USE THE CHART.

1. There were 6

Some of them went away.
Then there was 1 left.
How many went away?

6	
1	

6
− 1
5

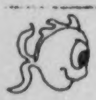
---

2. There were 3
2 more came.
How many were there then?

3	2

3
+ 2
5

---

3. There were some . 3 more came.
Then there were 8.
How many were there to start with?

8	
3	

8
− 3
5

---

4. There were 7 .
Some went away.
Then there were 2 left.
How many went away?

7	
2	

7
− 2
5

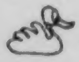
---

5. There were some .
4 more came.
Then there were 10.
How many were there to start with?

10	
4	

10
− 4
6

---

6. There were 3 .
Some more came.
Then there were 9.

How many came?

9	
3	

9
− 3
6

C part 2

FIND THE ANSWERS.

1.

Peep had 7 cakes.
Then he got some more.
Now Peep has 13.
How many did he get?

<table><tr><td colspan="2">13</td></tr><tr><td>7</td><td></td></tr></table>

$$\begin{array}{r} 13 \\ -7 \\ \hline 6 \end{array}$$

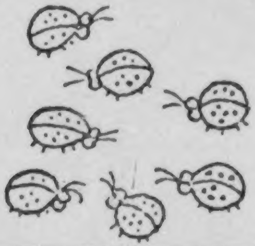
2.

Silly had some pennies.
Then he got 3 more.
Now Silly has 14 pennies.
How many pennies did Silly have to start with?

<table><tr><td colspan="2">14</td></tr><tr><td>3</td><td></td></tr></table>

$$\begin{array}{r} 14 \\ -3 \\ \hline 11 \end{array}$$

3.



Once I had 7 bugs.
I got some more.
Now I have 16 bugs.
How many did I get?

<table><tr><td colspan="2">16</td></tr><tr><td>7</td><td></td></tr></table>

$$\begin{array}{r} 16 \\ -7 \\ \hline 9 \end{array}$$

4.

I had some cubes.
Then I found 12 more.
Now I have 15.
How many did I have to start with?

<table><tr><td colspan="2">15</td></tr><tr><td>12</td><td></td></tr></table>

$$\begin{array}{r} 15 \\ -12 \\ \hline 3 \end{array}$$

5.

Yesterday I had 6 worms.
I ate some.
Now I have 0 left.
How many did I eat?

<table><tr><td colspan="2">6</td></tr><tr><td>0</td><td></td></tr></table>

$$\begin{array}{r} 6 \\ -0 \\ \hline 6 \end{array}$$

6.

Silly had 9 pies.
He ate some.
There are 2 left.
How many did he eat?

<table><tr><td colspan="2">9</td></tr><tr><td>2</td><td></td></tr></table>

$$\begin{array}{r} 9 \\ -2 \\ \hline 7 \end{array}$$

c part 2

GRUMPLFLERG (BIG G) IS A MAGICIAN.
HE HAS MAGIC HATS. HERE ARE SOME STORIES ABOUT HIM.

Find the answer for each story. Use the chart.

---

1. Big G had 7 white hats.
The rest of his hats were red.
He had 11 hats altogether.
How many hats were red?

11	
7	

11
−7
4

2. Big G had 8 big hats.
He had 3 small hats.
How many hats did he have altogether?

8	3

8
+3
11

3. He had 7 white hats.
2 of them had spots.
The rest did not.
How many did not have spots?

7	
2	

7
−2
5

4. Big G had 11 hats.
Some of them were on the table.
The rest were in the car.
6 are in the car. How many
are on the table?

11	
6	

11
−6
5

5. Big G had 11 hats.
He got 4 more.
How many does he have now?

[illegible]	
11	4

11
+4
15

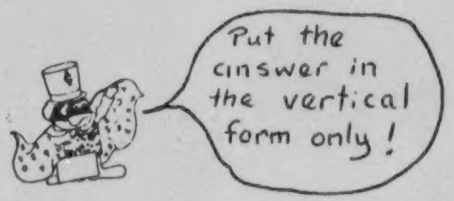
C part 2

6. Big G had 15 hats.
8 of them were paper.
The rest were not.
How many were not paper?

15	
8	

15
−8
7

SOLVE THE FOLLOWING SENTENCES.
LABEL THE WHOLE AND THE PARTS, FILL IN THE CHART, WRITE THE VERTICAL NOTATION, AND SOLVE.


Put the answer in the vertical form only!

EXAMPLE:

6 + 7 = ☐
P P W

6	7

$\begin{array}{r} 6 \\ +\ 7 \\ \hline 13 \end{array}$

---

12 - 4 = ☐
W P P

12	
4	

$\begin{array}{r} 12 \\ -\ 4 \\ \hline 8 \end{array}$

10 + 5 = ☐
P P W

10	5

$\begin{array}{r} 10 \\ +\ 5 \\ \hline 15 \end{array}$

14 - 7 = ☐
W P P

14	
7	

$\begin{array}{r} 14 \\ -\ 7 \\ \hline 7 \end{array}$

8 - 3 = ☐
W P P

8	
3	

$\begin{array}{r} 8 \\ -\ 3 \\ \hline 5 \end{array}$

D part 1

11 - 9 = ☐
W P P

11	
9	

$\begin{array}{r} 11 \\ -\ 9 \\ \hline 2 \end{array}$

6 + 3 = ☐
P P W

6	3

$\begin{array}{r} 6 \\ +\ 3 \\ \hline 9 \end{array}$

13 - 9 = ☐
W P P

13	
9	

$\begin{array}{r} 13 \\ -\ 9 \\ \hline 4 \end{array}$

5 + 4 = ☐
P P W

5	4

$\begin{array}{r} 5 \\ +\ 4 \\ \hline 9 \end{array}$

7 + 0 = ☐
P P W

7	0

$\begin{array}{r} 7 \\ +\ 0 \\ \hline 7 \end{array}$

9 + 3 = ☐
P P W

9	3

$\begin{array}{r} 9 \\ +\ 3 \\ \hline 12 \end{array}$

LABEL THE WHOLE AND THE PARTS. FILL IN THE CHART.
WRITE THE VERTICAL FORM, THEN SOLVE.

A

2 + 9 = ☐
p p w

2	9

$$\begin{array}{r} 2 \\ +\ 9 \\ \hline 11 \end{array}$$

B

8 - 4 = ☐
w p p

8	
4	

$$\begin{array}{r} 8 \\ -\ 4 \\ \hline 4 \end{array}$$

C

6 + 6 = ☐
p p w

6	6

$$\begin{array}{r} 6 \\ +\ 6 \\ \hline 12 \end{array}$$

D

0 + 19 = ☐
p p w

0	19

$$\begin{array}{r} 0 \\ +19 \\ \hline 19 \end{array}$$

E

13 - 6 = ☐
w p p

13	
6	

$$\begin{array}{r} 13 \\ -\ 6 \\ \hline 7 \end{array}$$

F

12 - 4 = ☐
w p p

12	
4	

$$\begin{array}{r} 12 \\ -\ 4 \\ \hline 8 \end{array}$$

G

7 + 5 = ☐
p p w

7	5

$$\begin{array}{r} 7 \\ +\ 5 \\ \hline 12 \end{array}$$

H

3 + 10 = ☐
p p w

3	10

$$\begin{array}{r} 3 \\ +10 \\ \hline 13 \end{array}$$

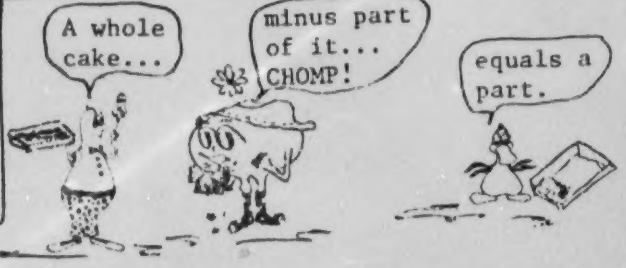
D part 1

I

14 - 5 = ☐
W p p

14	
5	

$$\begin{array}{r} 14 \\ -\ 5 \\ \hline 9 \end{array}$$


A whole cake...
minus part of it... CHOMP!
equals a part.

MYSTERY SENTENCES

One day the magicians gave these mystery sentences to Silly and Franny. Help Silly and Franny decide what number goes in each mystery box.

$7 - \boxed{1} = 6$

$4 + \boxed{4} = 8$

$\boxed{5} - 2 = 3$

$\boxed{3} + 2 = 5$

$\boxed{5} + 3 = 8$

$4 + 2 = \boxed{6}$

$6 + \boxed{1} = 7$

$10 - \boxed{3} = 7$

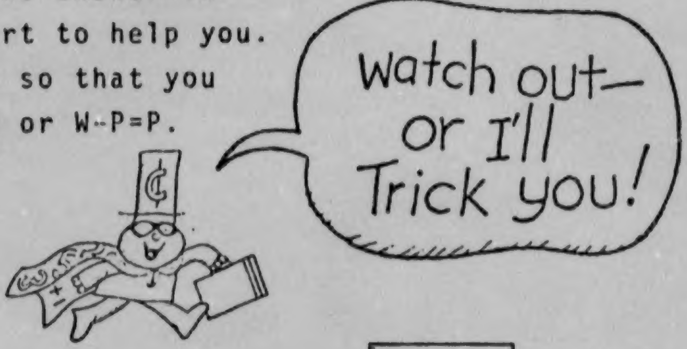
$\boxed{9} - 3 = 6$

D part 2

$0 + 5 = \boxed{5}$

MORE MYSTERY SENTENCES

Solve the sentences. Write the answer in the mystery box. Use the chart to help you. Label the whole and the parts so that you know if the sentence is P+P=W or W-P=P.


¢
Watch out—
or I'll
Trick you!

$5 + \boxed{6} = 11$
p p w

11	
5	

$\begin{array}{r}11\\-5\\\hline 6\end{array}$

$\boxed{3} - 2 = 1$
w p p

2	1

$\begin{array}{r}2\\+1\\\hline 3\end{array}$

$4 + \boxed{2} = 6$
p p w

6	
4	

$\begin{array}{r}6\\-4\\\hline 2\end{array}$

$13 - \boxed{4} = 9$
w p p

13	
9	

$\begin{array}{r}13\\-9\\\hline 4\end{array}$

$12 - \boxed{5} = 7$
w p p

12	
7	

$\begin{array}{r}12\\-7\\\hline 5\end{array}$

$\boxed{9} + 5 = 14$
p p w

14	
5	

$\begin{array}{r}14\\-5\\\hline 9\end{array}$

$\boxed{3} + 8 = 11$
p p w

11	
8	

$\begin{array}{r}11\\-8\\\hline 3\end{array}$

$9 - \boxed{5} = 4$
w p p

9	
4	

$\begin{array}{r}9\\-4\\\hline 5\end{array}$

$14 - \boxed{8} = 6$
w p p

14	
6	

$\begin{array}{r}14\\-6\\\hline 8\end{array}$

D part 3

$\boxed{10} - 3 = 7$
W p p

3	7

$\begin{array}{r}3\\+7\\\hline 10\end{array}$

$10 - \boxed{8} = 2$
w p p

10	
2	

$\begin{array}{r}10\\-2\\\hline 8\end{array}$

SOLVE THE SENTENCES. LABEL THE PARTS AND THE WHOLE.

USE THE CHART. WRITE THE ANSWER IN THE MYSTERY BOX.

$\boxed{10} - 3 = 7$

w p p

7	3

$\begin{array}{r} 7 \\ +3 \\ \hline 10 \end{array}$

$3 + \boxed{3} = 6$

p p w

6	
3	

$\begin{array}{r} 6 \\ -3 \\ \hline 3 \end{array}$

$0 + 8 = \boxed{8}$

p p w

0	8

$\begin{array}{r} 0 \\ +8 \\ \hline 8 \end{array}$

$\boxed{1} + 5 = 6$

p p w

6	
5	

$\begin{array}{r} 6 \\ -5 \\ \hline 1 \end{array}$

$7 - \boxed{0} = 7$

w p p

7	
7	

$\begin{array}{r} 7 \\ -7 \\ \hline 0 \end{array}$

$\boxed{9} + 0 = 9$

~~w~~p p w

9	
0	9

$\begin{array}{r} 9 \\ -0 \\ \hline 9 \end{array}$

D part 3.

$\boxed{8} - 4 = 4$

w p p

4	4

$\begin{array}{r} 4 \\ +4 \\ \hline 8 \end{array}$

$4 + \boxed{4} = 8$

p p w

8	
4	

$\begin{array}{r} 8 \\ -4 \\ \hline 4 \end{array}$

$\boxed{7} + 2 = 9$

p p w

9	
2	

$\begin{array}{r} 9 \\ -2 \\ \hline 7 \end{array}$

$9 - \boxed{5} = 4$

w p p

9	
4	

$\begin{array}{r} 9 \\ -4 \\ \hline 5 \end{array}$

$\boxed{2} + 6 = 8$

p p w

8	
6	

$\begin{array}{r} 8 \\ -6 \\ \hline 2 \end{array}$

$8 + 2 = \boxed{10}$

p p w

8	2

$\begin{array}{r} 8 \\ +2 \\ \hline 10 \end{array}$

$10 - 5 = \boxed{5}$

w p p

10	
5	

$\begin{array}{r} 10 \\ -5 \\ \hline 5 \end{array}$

$9 + \boxed{1} = 10$

p p w

10	
9	

$\begin{array}{r} 10 \\ -9 \\ \hline 1 \end{array}$

SOLVE THESE.

$\underset{w}{\boxed{11}} - \underset{p}{7} = \underset{p}{4}$ $\begin{array}{|c|c|}\hline \multicolumn{2}{|c|}{} \\ \hline 7 & 4 \\ \hline \end{array}$ $\begin{array}{r} 7 \\ +4 \\ \hline 11 \end{array}$

$\underset{p}{\boxed{9}} + \underset{p}{3} = \underset{w}{12}$ $\begin{array}{|c|c|}\hline \multicolumn{2}{|c|}{12} \\ \hline 3 & \\ \hline \end{array}$ $\begin{array}{r} 12 \\ -3 \\ \hline 9 \end{array}$

$\underset{w}{13} - \underset{p}{\boxed{8}} = \underset{p}{5}$ $\begin{array}{|c|c|}\hline \multicolumn{2}{|c|}{13} \\ \hline 5 & \\ \hline \end{array}$ $\begin{array}{r} 13 \\ -5 \\ \hline 8 \end{array}$

$\underset{p}{9} + \underset{p}{\boxed{5}} = \underset{w}{14}$ $\begin{array}{|c|c|}\hline \multicolumn{2}{|c|}{14} \\ \hline 9 & \\ \hline \end{array}$ $\begin{array}{r} 14 \\ -9 \\ \hline 5 \end{array}$

$\underset{w}{10} - \underset{p}{6} = \underset{p}{\boxed{4}}$ $\begin{array}{|c|c|}\hline \multicolumn{2}{|c|}{10} \\ \hline 6 & \\ \hline \end{array}$ $\begin{array}{r} 10 \\ -6 \\ \hline 4 \end{array}$

$\underset{p}{8} + \underset{p}{4} = \underset{w}{\boxed{12}}$ $\begin{array}{|c|c|}\hline \multicolumn{2}{|c|}{} \\ \hline 8 & 4 \\ \hline \end{array}$ $\begin{array}{r} 8 \\ +4 \\ \hline 12 \end{array}$

$\underset{p}{\boxed{4}} + \underset{p}{5} = \underset{w}{9}$ $\begin{array}{|c|c|}\hline \multicolumn{2}{|c|}{9} \\ \hline 5 & \\ \hline \end{array}$ $\begin{array}{r} 9 \\ -5 \\ \hline 4 \end{array}$

$\underset{w}{\boxed{8}} - \underset{p}{0} = \underset{p}{8}$ $\begin{array}{|c|c|}\hline \multicolumn{2}{|c|}{} \\ \hline 8 & 0 \\ \hline \end{array}$ $\begin{array}{r} 8 \\ +0 \\ \hline 8 \end{array}$

$\underset{p}{7} + \underset{p}{\boxed{6}} = \underset{w}{13}$ $\begin{array}{|c|c|}\hline \multicolumn{2}{|c|}{13} \\ \hline 7 & \\ \hline \end{array}$ $\begin{array}{r} 13 \\ -7 \\ \hline 6 \end{array}$

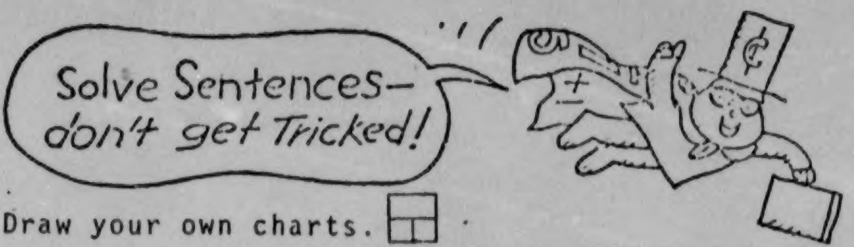
$\underset{w}{10} - \underset{p}{\boxed{7}} = \underset{p}{3}$ $\begin{array}{|c|c|}\hline \multicolumn{2}{|c|}{10} \\ \hline 3 & \\ \hline \end{array}$ $\begin{array}{r} 10 \\ -3 \\ \hline 7 \end{array}$

$\underset{p}{2} + \underset{p}{3} = \underset{w}{\boxed{5}}$ $\begin{array}{|c|c|}\hline \multicolumn{2}{|c|}{} \\ \hline 2 & 3 \\ \hline \end{array}$ $\begin{array}{r} 2 \\ +3 \\ \hline 5 \end{array}$

$\underset{w}{11} - \underset{p}{5} = \underset{p}{\boxed{6}}$ $\begin{array}{|c|c|}\hline \multicolumn{2}{|c|}{11} \\ \hline 5 & \\ \hline \end{array}$ $\begin{array}{r} 11 \\ -5 \\ \hline 6 \end{array}$

$\underset{p}{6} + \underset{p}{\boxed{2}} = \underset{w}{8}$ $\begin{array}{|c|c|}\hline \multicolumn{2}{|c|}{8} \\ \hline 6 & \\ \hline \end{array}$ $\begin{array}{r} 8 \\ -6 \\ \hline 2 \end{array}$

$\underset{w}{7} - \underset{p}{\boxed{4}} = \underset{p}{3}$ $\begin{array}{|c|c|}\hline \multicolumn{2}{|c|}{7} \\ \hline 3 & \\ \hline \end{array}$ $\begin{array}{r} 7 \\ -3 \\ \hline 4 \end{array}$


Solve Sentences—
don't get Tricked!
+
¢

Draw your own charts. ⊞

a. 6 + 6 = 12   6|6

b. 0 + 8 = 8   8 / 8|

c. 9 − 8 = 1   9 / 8|

e. 7 − 2 = 5   7 / 5|

i. 5 + 3 = 8   8 / 3|

k. 10 − 4 = 6   10 / 6|

l. 3 − 1 = 2   1|2

r. 7 + 6 = 13   7|6

s. 8 + 2 = 10   8|2

t. 10 − 9 = 1   10 / 1|

u. 1 + 7 = 8   1|7

w. 9 − 3 = 6   9 / 3|

x. 3 + 4 = 7   3|4

y. 6 + 5 = 11   6|5

Write the letter of the sentence with its answer below. Change the letters around to spell the names of things that move in a city.

10 0 8 12 6 11
s b u a w y   subway

12 1 13
a c r   car

9 8 1 4 13
t u c k r   truck

5 12 9 7
i a t x   tax 320

0 5 1 1 11 3 2
b i c c y l e   bicycle

WHICH FITS

Circle the solution if there is one here.
Draw your own charts.

1

$8 - \square = 4$

8 | 4

$8 - 4 = 4$

[✓ 4], 3, 2, 1

2

$1 + 2 = \square$

1 | 2

[✓ 3], 5, 2, 1

3

$\square - 1 = 8$

w p p

1 | 8

$1 + 8 = 9$

7, 0, 8, 4 None

4

$\square + 2 = 7$

7 | 2

9, [✓ 5], 7, 4

5

$3 + \square = 10$

10 | 3

$10 - 3 = 7$

8, 4, 6, 2

None

Ш

6

$\square - 1 = 13$

w p p

1 | 13

2, 12, [✓ 14], 17

7

$\square + 7 = 15$

15 | 7

$15 - 7 = 8$

7, 2, 12, 9 None

8

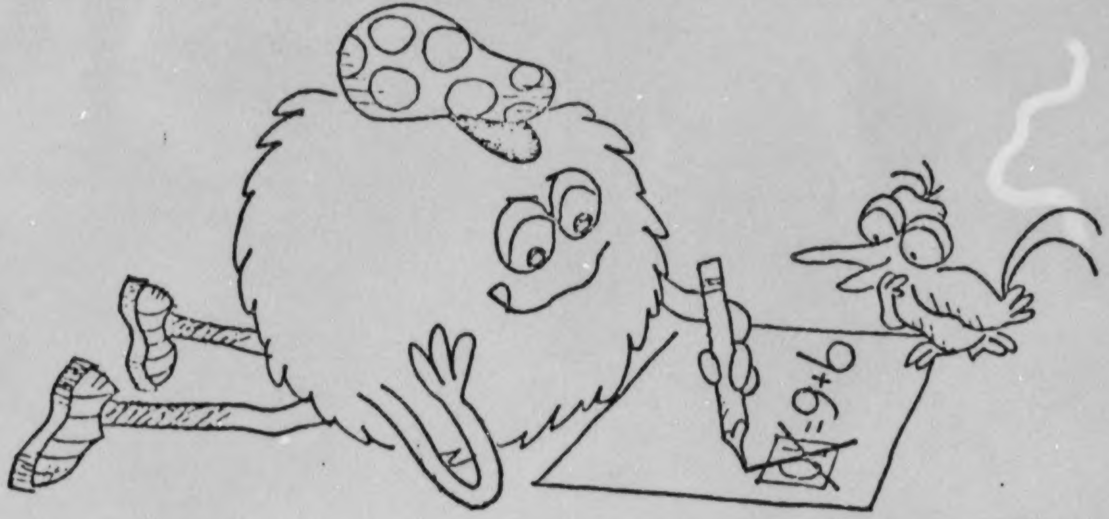
$14 - 6 = \square$

14 | 6

6, 20, 10, [✓ 8]

MISTAKEN MYSTERIES

Mark out the false answers in the mystery boxes.
Then write the correct answer.



$3+\boxed{2}=5$ ok

$9-6=\overset{3}{\boxed{\cancel{10}}}$

$\overset{9}{\boxed{\cancel{7}}}-1=8$

$1+\boxed{3}=4$

$5-\boxed{4}=1$

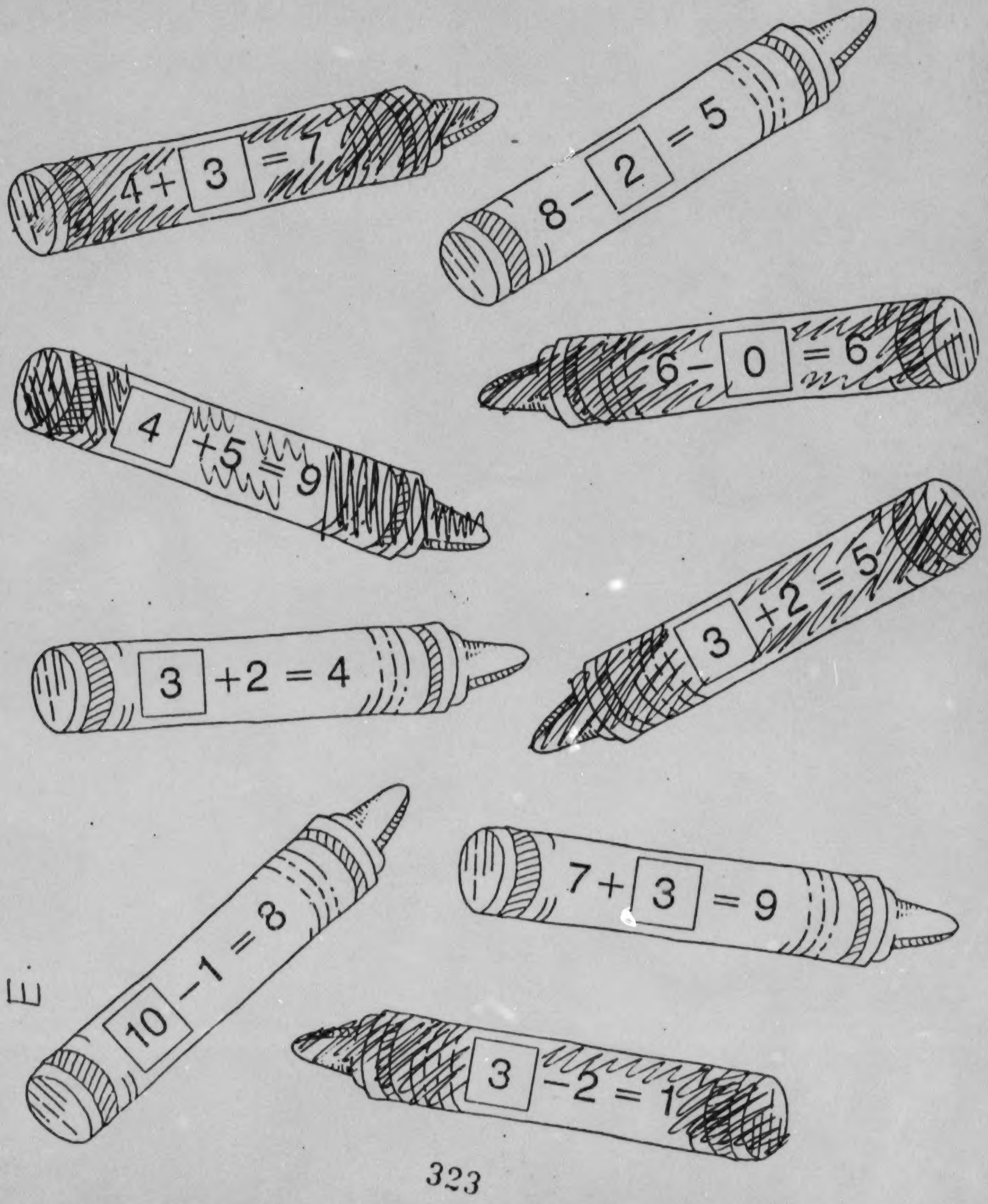
$\overset{9}{\boxed{\cancel{0}}}+1=10$

$10-6=\boxed{4}$

$4+4=\overset{8}{\boxed{\cancel{0}}}$

$\overset{8}{\boxed{\cancel{5}}}+1=9$

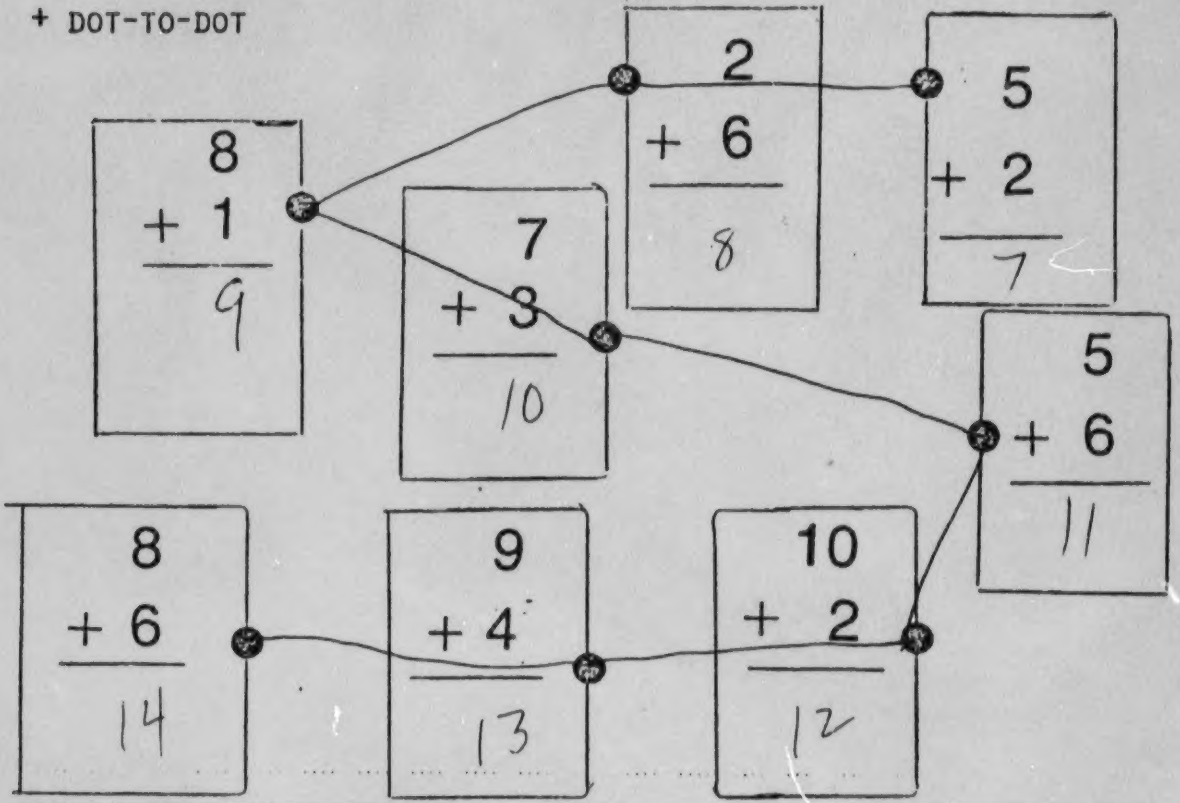
$\overset{5}{\boxed{\cancel{3}}}+3=8$


4 + 3 = 7
8 − 2 = 5
6 − 0 = 6
4 + 5 = 9
3 + 2 = 5
3 + 2 = 4
10 − 1 = 8
7 + 3 = 9
3 − 2 = 1
E

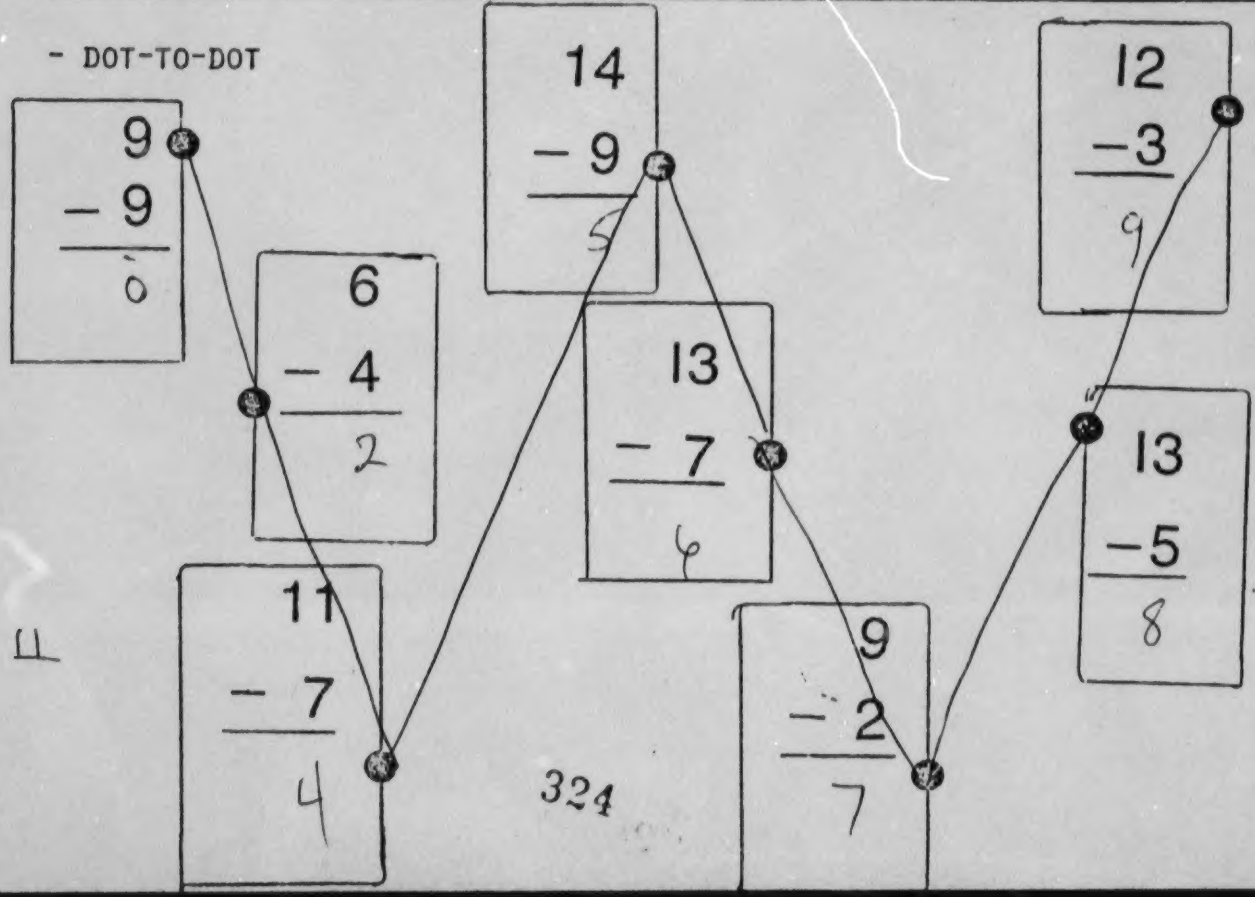
HIDDEN LETTERS

Solve. Then follow your teacher's directions

+ DOT-TO-DOT


8 + 1 = 9
2 + 6 = 8
5 + 2 = 7
7 + 3 = 10
5 + 6 = 11
8 + 6 = 14
9 + 4 = 13
10 + 2 = 12

- DOT-TO-DOT


9 − 9 = 0
14 − 9 = 5
12 − 3 = 9
6 − 4 = 2
13 − 7 = 6
13 − 5 = 8
11 − 7 = 4
9 − 2 = 7

Find the mystery numbers.

We are more than $\begin{array}{r}5\\+1\\\hline 6\end{array}$ but less than $\begin{array}{r}13\\-4\\\hline 9\end{array}$

What numbers are we? 7, 8

We are more than $\begin{array}{r}11\\-8\\\hline 3\end{array}$ but less than $\begin{array}{r}6\\+5\\\hline 11\end{array}$

What numbers are we? 4, 5, 6, 7, 8, 9, 10

We are more than $\begin{array}{r}10\\-4\\\hline 6\end{array}$ but less than $\begin{array}{r}7\\+7\\\hline 14\end{array}$

What numbers are we? 7, 8, 9, 10, 11, 12, 13

We are more than $\begin{array}{r}9\\+2\\\hline 11\end{array}$ but less than $\begin{array}{r}6\\+8\\\hline 14\end{array}$

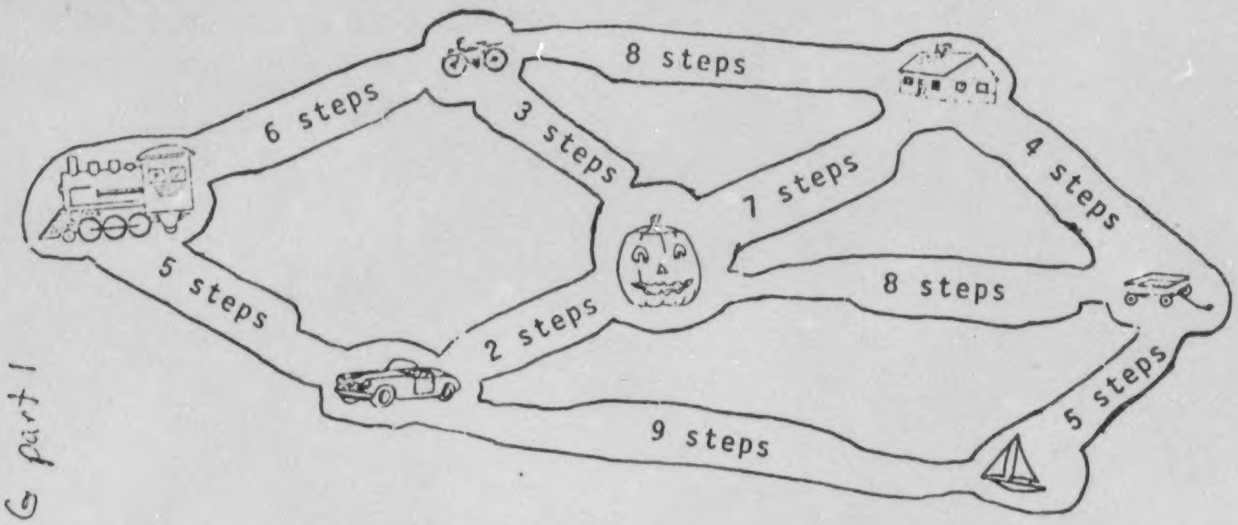
What numbers are we? 12, 13

4

We are more than $\begin{array}{r}10\\-8\\\hline 2\end{array}$ but less than $\begin{array}{r}12\\-3\\\hline 9\end{array}$

What numbers are we? 3, 4, 5, 6, 7, 8

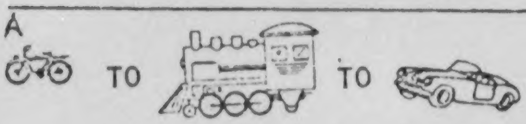
Use this map to find how many steps.


6 steps
8 steps
3 steps
7 steps
4 steps
5 steps
2 steps
8 steps
5 steps
9 steps

G part 1

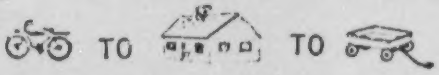
HOW MANY STEPS FROM. . .

A



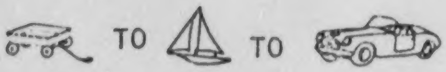
6
+ 5
11

B



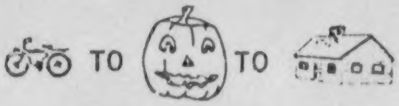
8
+ 4
12

C



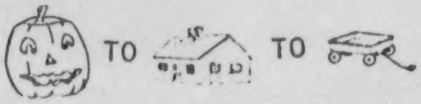
5
+ 9
14

D



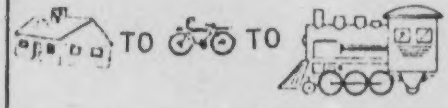
3
+ 7
10

E



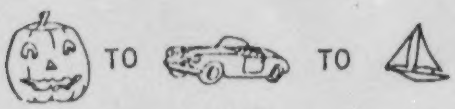
7
+ 4
11

F



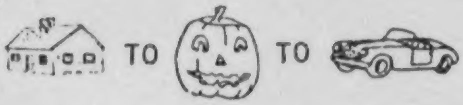
8
+ 6
14

G



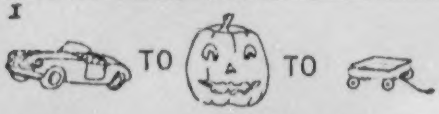
2
+ 9
11

H



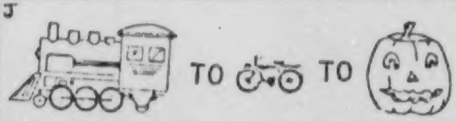
7
+ 2
9

I



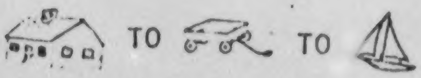
2
+ 8
10

J



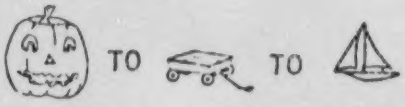
6
+ 3
9

K



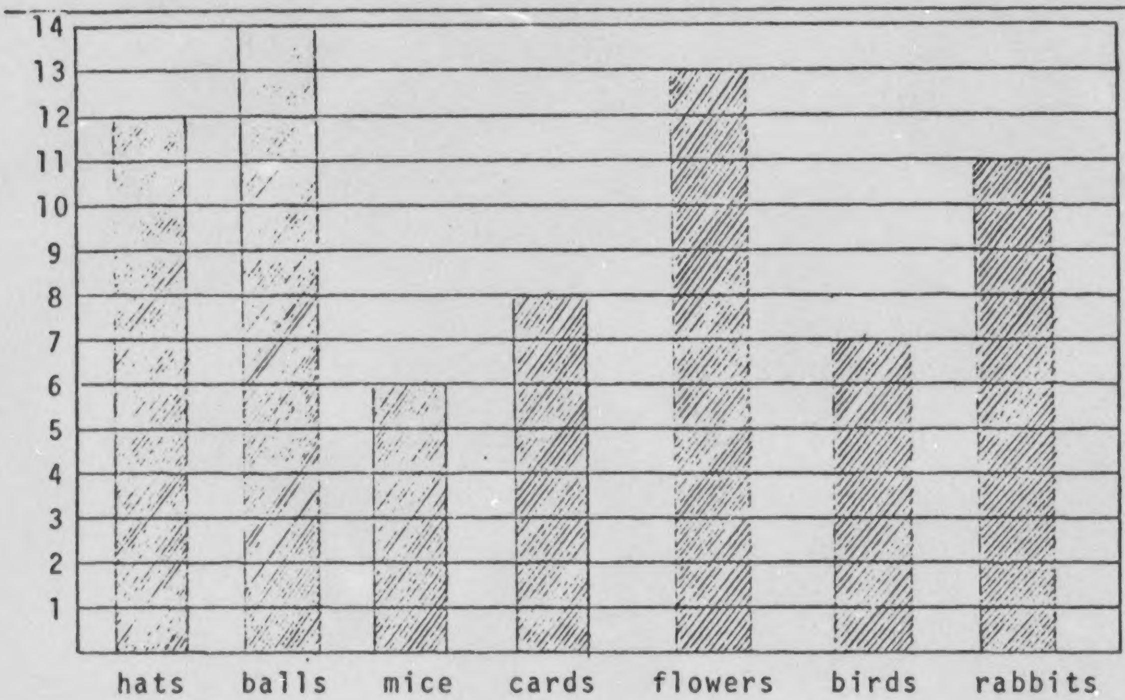
4
+ 5
9

L



8
+ 5
13

Franny counted the magicians things. Then she made this graph. Use it to answer the questions.



1. How many more hats than cards are there?.

12 - 8 = 4

2. How many more balls than mice are there?

14 - 6 = 8

3. How many more flowers than birds are there?

13 - 7 = 6

4. How many more rabbits than mice are there?

11 - 6 = 5

5. How many birds and mice are there altogether?

7 + 6 = 13

6. How many more flowers than cards are there?

13 - 8 = 5

7. How many more hats than mice are there?

12 - 6 = 6

8. How many more rabbits than birds are there?

11 - 7 = 4

9. How many more balls than birds are there?

14 - 7 = 7

G part 1

Find the sums or differences.

A	7	6	5	4	3	2
	+ 7	+ 6	+ 5	+ 4	+ 3	+ 2
	14	12	10	8	6	4
B	9	9	10	10	8	8
	+ 1	- 1	+ 1	- 1	+ 1	- 1
	10	8	11	9	9	7
C	10	12	4	6	8	14
	- 5	- 6	- 2	- 3	- 4	- 7
	5	6	2	3	4	7
D	10	7	9	8	6	10
	+ 1	+ 5	+ 2	+ 4	+ 5	+ 2
	11	12	11	12	11	12
E	9	9	9	9	9	9
	+ 5	+ 0	+ 3	+ 2	+ 4	+ 1
	14	9	12	11	13	10

G part 2

THE DO AND UNDO MYSTERY

Find the sums and differences.

$$\begin{array}{r} 7 \\ +\ 6 \\ \hline 13 \end{array} \rightarrow \begin{array}{r} 13 \\ -\ 4 \\ \hline 9 \end{array} \rightarrow \begin{array}{r} 9 \\ -\ 2 \\ \hline 7 \end{array} \qquad \begin{array}{r} 9 \\ -\ 6 \\ \hline 3 \end{array} \rightarrow \begin{array}{r} 3 \\ +\ 2 \\ \hline 5 \end{array} \rightarrow \begin{array}{r} 5 \\ +\ 4 \\ \hline 9 \end{array}$$

$$\begin{array}{r} 14 \\ -\ 8 \\ \hline 6 \end{array} \rightarrow \begin{array}{r} 6 \\ +\ 3 \\ \hline 9 \end{array} \rightarrow \begin{array}{r} 9 \\ +\ 5 \\ \hline 14 \end{array} \qquad \begin{array}{r} 4 \\ +\ 9 \\ \hline 13 \end{array} \rightarrow \begin{array}{r} 13 \\ -\ 4 \\ \hline 9 \end{array} \rightarrow \begin{array}{r} 9 \\ -\ 5 \\ \hline 4 \end{array}$$

$$\begin{array}{r} 2 \\ +\ 8 \\ \hline 10 \end{array} \rightarrow \begin{array}{r} 10 \\ -\ 6 \\ \hline 4 \end{array} \rightarrow \begin{array}{r} 4 \\ -\ 2 \\ \hline 2 \end{array} \qquad \begin{array}{r} 12 \\ -\ 4 \\ \hline 8 \end{array} \rightarrow \begin{array}{r} 8 \\ +\ 1 \\ \hline 9 \end{array} \rightarrow \begin{array}{r} 9 \\ +\ 3 \\ \hline 12 \end{array}$$

$$\begin{array}{r} 4 \\ +\ 7 \\ \hline 11 \end{array} \rightarrow \begin{array}{r} 11 \\ -\ 3 \\ \hline 8 \end{array} \rightarrow \begin{array}{r} 8 \\ -\ 4 \\ \hline 4 \end{array} \qquad \begin{array}{r} 11 \\ -\ 9 \\ \hline 2 \end{array} \rightarrow \begin{array}{r} 2 \\ +\ 6 \\ \hline 8 \end{array} \rightarrow \begin{array}{r} 8 \\ +\ 3 \\ \hline 11 \end{array}$$

G part 2

$$\begin{array}{r} \textcircled{10} \\ -\ 6 \\ \hline \cancel{3}4 \end{array} \rightarrow \begin{array}{r} 4 \\ +\ 5 \\ \hline 9 \end{array} \rightarrow \begin{array}{r} 9 \\ +\ 1 \\ \hline \textcircled{10} \end{array}$$

I start with 10.
I end with 10. Can you guess the secret of my do and undo mystery? Try to make your own do and undo.

Find the sums or differences.

$1 + 13 = \boxed{13}$
$13 + 1 = \boxed{13}$

$11 - 3 = \boxed{8}$
$11 - 8 = \boxed{3}$

$10 + 2 = \boxed{12}$
$2 + 10 = \boxed{12}$

$14 - 2 = \boxed{12}$
$12 + 2 = \boxed{14}$

$12 - 4 = \boxed{8}$
$12 - 8 = \boxed{4}$

$5 + 9 = \boxed{14}$
$9 + 5 = \boxed{14}$

$7 - 5 = \boxed{2}$
$7 - 2 = \boxed{5}$

$13 - 3 = \boxed{10}$
$10 + 3 = \boxed{13}$

$9 + 4 = \boxed{13}$
$4 + 9 = \boxed{13}$

$8 - 5 = \boxed{3}$
$8 - 3 = \boxed{5}$

$6 - 4 = \boxed{2}$
$6 - 2 = \boxed{4}$

$9 - 0 = \boxed{9}$
$9 + 0 = \boxed{9}$

$11 - 7 = \boxed{4}$
$11 - 4 = \boxed{7}$

$14 - 1 = \boxed{13}$
$14 - 13 = \boxed{1}$

$12 + 1 = \boxed{13}$
$1 + 12 = \boxed{13}$

$12 - 5 = \boxed{7}$
$7 + 5 = \boxed{12}$

G part 2

$0 + 13 = \boxed{13}$
$13 + 0 = \boxed{13}$

$6 + 8 = \boxed{14}$
$8 + 6 = \boxed{14}$

$10 - 0 = \boxed{10}$
$10 - 10 = \boxed{0}$

$11 - 5 = \boxed{6}$
$6 + 5 = \boxed{11}$

NUMBER FAMILIES

Find the sums or differences. Draw the chart for each family.

$$\begin{array}{rrrr} 7 & 11 & 11 & 4 \\ +4 & -4 & -7 & +7 \\ \hline 11 & 7 & 4 & 11 \end{array} \qquad \begin{array}{|c|c|}\hline \multicolumn{2}{|c|}{11} \\ \hline 7 & 4 \\ \hline\end{array}$$

$$\begin{array}{rrrr} 10 & 6 & 4 & 10 \\ -6 & +4 & +6 & -4 \\ \hline 4 & 10 & 10 & 6 \end{array} \qquad \begin{array}{|c|c|}\hline \multicolumn{2}{|c|}{10} \\ \hline 6 & 4 \\ \hline\end{array}$$

$$\begin{array}{rrrr} 9 & 3 & 12 & 12 \\ +3 & +9 & -3 & -9 \\ \hline 12 & 12 & 9 & 3 \end{array} \qquad \begin{array}{|c|c|}\hline \multicolumn{2}{|c|}{12} \\ \hline 3 & 9 \\ \hline\end{array}$$

$$\begin{array}{rrrr} 13 & 13 & 5 & 8 \\ -8 & -5 & +8 & +5 \\ \hline 5 & 8 & 13 & 13 \end{array} \qquad \begin{array}{|c|c|}\hline \multicolumn{2}{|c|}{13} \\ \hline 5 & 8 \\ \hline\end{array}$$

$$\begin{array}{rrrr} 4 & 2 & 6 & 6 \\ +2 & +4 & -4 & -2 \\ \hline 6 & 6 & 2 & 4 \end{array} \qquad \begin{array}{|c|c|}\hline \multicolumn{2}{|c|}{6} \\ \hline 4 & 2 \\ \hline\end{array}$$

$$\begin{array}{rrrr} 7 & 2 & 9 & 9 \\ +2 & +7 & -2 & -7 \\ \hline 9 & 9 & 7 & 2 \end{array} \qquad \begin{array}{|c|c|}\hline \multicolumn{2}{|c|}{9} \\ \hline 2 & 7 \\ \hline\end{array}$$

Complete these families. Draw the chart for each.

$$\begin{array}{rrrr} 6 & 3 & 9 & 9 \\ +3 & +6 & -3 & -6 \\ \hline 9 & 9 & 6 & 3 \end{array} \qquad \begin{array}{|c|c|}\hline \multicolumn{2}{|c|}{9} \\ \hline 6 & 3 \\ \hline\end{array}$$

$$\begin{array}{rrrr} 14 & 14 & 8 & 6 \\ -6 & -8 & +6 & +8 \\ \hline 8 & 6 & 14 & 14 \end{array} \qquad \begin{array}{|c|c|}\hline \multicolumn{2}{|c|}{14} \\ \hline 8 & 6 \\ \hline\end{array}$$

← part 2

$$\begin{array}{rrrr} 12 & 12 & 5 & 7 \\ -5 & -7 & +7 & +5 \\ \hline 7 & 5 & 12 & 12 \end{array} \qquad \begin{array}{|c|c|}\hline \multicolumn{2}{|c|}{12} \\ \hline 5 & 7 \\ \hline\end{array}$$

$$\begin{array}{rrrr} 9 & 4 & 13 & 13 \\ +4 & +9 & -4 & -9 \\ \hline 13 & 13 & 9 & 4 \end{array} \qquad \begin{array}{|c|c|}\hline \multicolumn{2}{|c|}{13} \\ \hline 9 & 4 \\ \hline\end{array}$$

A

Topic Inventory S4 page A

318 Find the answer for each story.
Use the chart to help.

1. 3 blue cars
6 red cars
How many cars altogether?

<table><tr><td colspan="2"></td></tr><tr><td>3</td><td>6</td></tr></table>

$$\begin{array}{r} 3 \\ +\,6 \\ \hline 9 \end{array}$$

2. 8 cars altogether.
2 are green.
The rest are white.
How many cars are white?

<table><tr><td colspan="2">8</td></tr><tr><td>2</td><td></td></tr></table>

$$\begin{array}{r} 8 \\ -\,2 \\ \hline 6 \end{array}$$

3. There are 12 cars.
Some go away.
4 are left.
How many went away?

<table><tr><td colspan="2">12</td></tr><tr><td>4</td><td></td></tr></table>

$$\begin{array}{r} 12 \\ -\,4 \\ \hline 8 \end{array}$$

4. There are some cars.
5 go away.
6 are left.
How many cars were there to start with?

<table><tr><td colspan="2"></td></tr><tr><td>5</td><td>6</td></tr></table>

$$\begin{array}{r} 5 \\ +\,6 \\ \hline 11 \end{array}$$

5. There are some cars.
3 more come.
Now there are 9 cars.
How many were there to start with?

<table><tr><td colspan="2">9</td></tr><tr><td>3</td><td></td></tr></table>

$$\begin{array}{r} 9 \\ -\,3 \\ \hline 4 \end{array}$$

6. There are 7 cars.
Some more cars come.
Now there are 11 cars.
How many cars came?

<table><tr><td colspan="2">11</td></tr><tr><td>7</td><td></td></tr></table>

$$\begin{array}{r} 11 \\ -\,7 \\ \hline 4 \end{array}$$

7. There were 5 cars.
7 more came.
How many cars are there now?

<table><tr><td colspan="2"></td></tr><tr><td>5</td><td>7</td></tr></table>

$$\begin{array}{r} 5 \\ +\,7 \\ \hline 12 \end{array}$$

8. There are some red and yellow cars.
6 are red.
4 are yellow.
How many red and yellow cars are there altogether?

6	4

$$\begin{array}{r}6\\+4\\\hline 10\end{array}$$

---

9. There were 13 cars.
7 went away.
How many are left?

13	
7	

$$\begin{array}{r}13\\-7\\\hline 6\end{array}$$

---

10. There were 13 cars.
Some went away.
5 are left.
How many went away?

13	
5	

$$\begin{array}{r}13\\-5\\\hline 8\end{array}$$

Add.

$$\begin{array}{r}7\\+3\\\hline 10\end{array}\qquad\begin{array}{r}6\\+6\\\hline 12\end{array}\qquad\begin{array}{r}2\\+9\\\hline 11\end{array}\qquad\begin{array}{r}0\\+7\\\hline 7\end{array}\qquad\begin{array}{r}4\\+8\\\hline 12\end{array}$$

Subtract.

$$\begin{array}{r}14\\-7\\\hline 7\end{array}\qquad\begin{array}{r}10\\-2\\\hline 8\end{array}\qquad\begin{array}{r}11\\-3\\\hline 8\end{array}\qquad\begin{array}{r}8\\-4\\\hline 4\end{array}\qquad\begin{array}{r}9\\-0\\\hline 9\end{array}$$

APPENDIX E

TOPIC S-5: SOLVING SITUATIONS AND SENTENCES 0-20

TOPIC S5 SOLVING SITUATIONS AND SENTENCES 0-20.

OBJECTIVES

Preparatory

1. Given an open sentence of the form $a + b = \square$ or $\begin{array}{r} a \\ \underline{+\ b} \end{array}$ involving the numbers 0-20, solves it. (solves $a + b = \square$ sentence 0-20).
2. Given an open sentence of the form $a - b = \square$ or $\begin{array}{r} a \\ \underline{-\ b} \end{array}$ involving the numbers 0-20, solves it. (solves $a = b = \square$ sentence 0-20).
3. Given an open situation involving the numbers 0-20 that is solvable by using either addition or subtraction writes a sentence that represents that situation. (writes open + or - sentence 0-20).

OVERVIEW

This topic reviews problem situations presented in previous sentence writing topics, particularly in Topic S4. In addition, for the first time, the part-part-whole chart is used to analyze difference situations and separating situations where the whole is unknown.

In some activities the children are asked to fill in the part-part-whole chart, to write a sentence, and to write the problem in vertical notation.

In this topic the children continue to practice solving sentences involving the numbers 0-20. Many of the children are ready to work symbolically; others still need to use objects, pictures, or counting strategies when solving with facts beyond 10. Encourage those children who are ready to work symbolically, but do not discourage those who are not ready by forcing them to solve symbolically too soon. As the children do the topic, watch for those who, with a little help, are ready to give up using objects. At this point you might help them estimate their solutions by asking a few questions about the size of the answers in relationship to the numbers being added or subtracted or in relationship to other facts the children may know. For example, if 2 + 3 = 5, 3 + 3 is one more, or 6.

Also, as the children read situations, encourage them to think carefully about the information presented. Begin by asking such questions as:

Do you think you'll add or subtact?

What is missing? What are you asked to find?

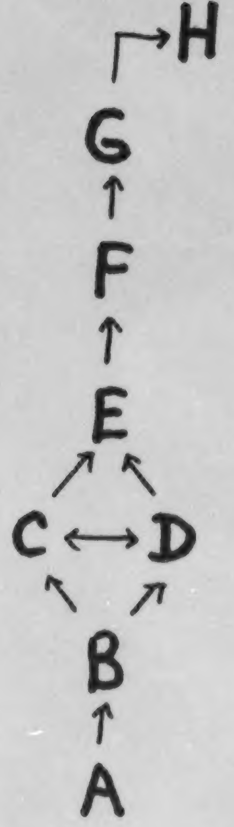
Is it the whole or a part? How can you tell?

If a part (whole is missing, what will you do to find it, add or subtract?

Does the answer make sense if you reread the story, plugging in the answer?

Try to help the children see the answer as part of the story.

SUGGESTED SEQUENCE CHART



ACTIVITY S5 A

This activity reviews situations from previous sentence writing topics. However, in this activity the children are asked to fill in the part-part-whole chart, write a sentence, and record in the vertical form before solving.

Objectives

1 solves $a + b = \square$ sentence 0-20

2 solves $a - b = \square$ sentence 0-20

3 writes open + or - sentence 0-20

Organization

large group

individual

Vocabulary

vertical form

Materials

Student Booklet pages 2-7

objects to solve with

Preparation

No special preparation

Teaching Suggestions

In previous topics the children were given a problem situation and asked :

a. to write a sentence and solve

b. to fill in the part-part-whole chart and solve

c. to write the numbers in vertical form and solve

d. any two of a, b, and c.

For the first time, the children are asked to do all three--fill in the chart, write the sentence, and record in vertical form before solving. Although the children should begin to rely more on their knowledge of the addition/subtraction facts 0-20, they may also solve by counting, using objects or pictures, or by some other method of their choice. Encourage the children to consider the reasonableness of their answers--should the number be greater or less than each of the other numbers in the problem? If I read the problem with the answer filled in, does it make sense? etc. Also ask the children to validate by using objects or some counting strategy.

Begin with a review of the part-part-whole chart, the sentence, and the up-and-down form for a situation. Introduce the term vertical form and explain that "vertical" means "up-and-down." This can be accomplished by doing the first two or three problems on Student Booklet page 2. You may choose to have the children write the correct answer in all three forms, or just in the vertical form. Have the children complete the pages on their own.

On Student Booklet page 2 the children are given two of the three responses (p-p-w chart, sentence, vertical form) and asked to write the third.

On Student Booklet page 3 the children are given one of the three responses and asked to write the other two.

When the children have completed pages 2 and 3, introduce Student Booklet page 4. Begin by having the children read with you the poem at the top of the page. This introduces the theme of the situations presented in this topic. You may also discuss what things the children collect.

Then do the following problems, which are based on the picture at the top of page 4. For each problem fill in the chart, write the sentence, write the vertical form, and solve.

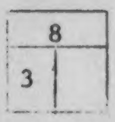
1. There are 9 sticks.
   Some are black.
   The rest, 5, are white.
   How many are black?

$$\begin{array}{|c|c|}\hline \multicolumn{2}{|c|}{9} \\ \hline 5 & \\ \hline \end{array} \qquad 9 - 5 = \boxed{4} \qquad \begin{array}{r} 9 \\ -5 \\ \hline 4 \end{array}$$

2. There are 6 children in the club.
   Seven more join.
   How many children now are in the club? (Could validate by drawing in seven more children and counting 6 - 7, 8, 9, 10, 11, 12, 13)

$$\begin{array}{|c|c|}\hline \multicolumn{2}{|c|}{13} \\ \hline 6 & \\ \hline \end{array} \qquad 6 + 7 = \boxed{13} \qquad \begin{array}{r} 6 \\ +7 \\ \hline 13 \end{array}$$

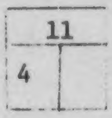
3. There are 8 leaves.
   Some are one shape (pointed).
   3 are another shape (curved).
   How many are pointed?



$8 - 3 = \boxed{5}$

$$\begin{array}{r} 8 \\ -3 \\ \hline 5 \end{array}$$

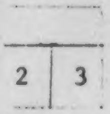
4. There are 11 rocks by the sign.
   Some are taken away.
   4 are left.
   How many were taken away?



$11 - 4 = \boxed{7}$

$$\begin{array}{r} 11 \\ -\ 4 \\ \hline 7 \end{array}$$

5. Nan measured a stick.
   It was 3 cubes long on one side of a small branch, and 2 cubes long on the other side.
   How long was the stick?



$2 + 3 = \boxed{5}$

$$\begin{array}{r} 2 \\ +3 \\ \hline 5 \end{array}$$

Then have the children finish page 4 and do Student Booklet page 5, which presents more, similar stories.

Next introduce Student Booklet pages 6 and 7. Explain that two members of the club got some of their collections mixed together and now they need to make sure each person gets the right number of things back. Do the first problem on page 6 with the children. Then let them finish page 6 and page 7 on their own. Remind them to fill in the chart, write a sentence, and write the vertical form.

ACTIVITY S5 B

In this activity, for the first time, the children write and solve difference sentences using the part-part-whole chart. This provides the background for why "difference" implies a subtraction sentence.

Objectives

1 solves $a + b = \square$ sentence 0-20

2 solves $a - b = \square$ sentence 0-20

3 writes open + or - sentence 0-20

Organization

large group (part 1)

pairs (part 1)

individual (part 2)

Materials

Student Booklet pages 8, 9, 10

links, cubes, chips, etc.

paper

Preparation

For each child, fill a small container with 1-20 objects.

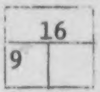
Teaching Suggestions

In this activity the children solve difference situations using the part-part-whole chart. Part 1 is active. Part 2 involves Student Booklet pages. The children should do both parts.

Part 1. This part shows how the part-part-whole chart analysis may be applied to difference situations, and provides the background for why difference implies subtraction.

Give each child from 0-20 objects (links, cubes, chips, counting sticks, etc.) as his/her collection. Have two volunteers come to the front of the room to count their collections. Ask: "Who has more things? How many more? How could we find how many more if we can't tell right away?"

Show the children how to match one-to-one, using the two collections. Say, "If the matched objects are one part and the unmatched objects are the other part, what is the whole? Do we know it?" (The whole is the larger collection and yes, we know it.)

Now draw the p-p-w chart. Explain that you and the children are going to fill in the chart and see if it will help to write a sentence about finding how many more. Have two more volunteers come up and count their sets. Identify who has more. Next ask where the numbers would go in the chart. (The number in the larger collection is the whole. The number in the smaller collection is the part of the larger collection that will be matched.) Fill in the chart. For example, the chart for 16 objects and 9 objects would be . Ask what is missing. (The other part or the unmatched part.) Have a volunteer write the sentence that could be used to find the other part. (16 - 9 = □) Solve and then verify by matching that the solution is correct.

Explain that it is the whole - part = the other part sentence that was used. Ask if anyone knows another name for the missing part (the difference).

Remind the children that they have done difference problems before. In difference problems they are usually given two sets to compare in order to find the difference. Remind them that they always subtracted to find the difference. Explain that now they should see why they subtracted. In a difference story, they are usually given the whole (the larger set) and one part (the smaller set or the set to be matched or taken away) and asked to find the other part (the difference or the unmatched part).

Next, with two more volunteers, change the question to, "How many less or fewer objects?" Lead the children to see that there is no change in the method used to solve; therefore, there is no change in the analysis of the whole and the parts and no change in the kind of sentence written. Point out that asking how many more or how many fewer is the same as asking to find the difference.

Do as many more examples using the children's collections as you think necessary. For each, fill in the p-p-w chart, write the sentence and solve by matching or by knowledge of the facts 0-20.

Next, give the children paper (to record on) and have them use their collections to write and solve difference sentences, as you had volunteers do at the front of the room. Each child should work in turn with 5 or 6 other children. Each child writes and solves the sentence. Children should then trade collections and do 5 or 6 more sentences.

Part 2. In this part the children write and solve difference sentences from situations presented on Student Booklet pages.

Student Booklet page 8. The children circle the larger number (or the person who has the larger collection) and then write and solve a sentence to find how many more one person has than the other.

Student Booklet page 9. Similar to page 8, except that the children circle the person with fewer buttons.

Student Booklet page 10. The children are given stories and asked to write and solve a sentence for each. Encourage the children to use the part-part-whole chart if they are having difficulty.

ACTIVITY S5 C

Alternate to S5D

This activity uses weight situations to give the children practice writing and solving sentences. Most situations given are difference situations.

Objectives

1 solves $a + b = \square$ sentence 0-20

2 solves $a - b = \square$ sentence 0-20

3 writes open + or - sentence 0-20

Organization

small group (Part 1)

individual (Part 2)

Materials

Student Booklet page 11 (Part 1)

Student Booklet pages 12, 13, 14, and 15 (Part 2)

24 objects to weigh (see Preparation) (Part 1)

balances (Part 1)

washers (Part 1)

masking tape for labels (Part 1)

Preparation

Set up 8 weight stations. At each put a balance, 20 small washers and 2 labeled objects (described below).

Collect 16 objects each weighing between 1-20 small washers with blank labels, letter each object.

Suggested objects:

roll of transparent tape

rod of 10 cubes

small container from kit

any of the geometric solids

small chalkboard eraser

chains of links

pair of children's scissors

2 pencils held together with a rubberband

a bundle of counting sticks

a small container with a few geometric pieces

a large washer

a pair of glasses

Teaching Suggestions

This activity uses weight situations to practice writing and solving sentences. Eight (or 16 if they work in pairs) of the children do Part 1, visiting weight stations while the rest work on Part 2. Then they change. Do the demonstration for Part 1 with all children first.

Part 1. Begin by having the children look at Student Booklet page 11. Point out that there are two parts: filling in information from the stations and answering the three questions at the bottom of the page. At the stations they are to compare two objects, as the chart indicates, guess the difference in their weight in the indicated unit, weigh both objects, and then write and solve a sentence about the difference in weight.

Demonstrate this process for the children making sure they understand where to record on Student Booklet page 11. Draw the following example on the board.

Letters		Guess	Weight		Sentence
1	2		1	2	
A	B	3	6	8	$8-6=\boxed{2}$

Next pick 8 children (or 16 if you want them to work in pairs) to do Part 1 first while the rest do Part 2. Each child doing Part 1 should visit 4 stations. When those 8 are done, they work on Part 2, while 8 more children do Part 1. Continue until all children have completed Parts 1 and 2 of this activity.

Part 2. In this part the children are given weight problem situations and asked to write and solve sentences. Encourage the use of the part-part-whole chart to analyze problems.

Student Booklet pages 12 and 13. The children use weights given on a chart to write and solve sentences. Page 13 should be detached from the booklet so that the children do not need to flip back and forth to refer to the chart on page 12.

Student Booklet page 14. On this page the children circle the heavier object and then write and solve a difference sentence.

Student Booklet page 15. The children circle the lighter objects and then write and solve difference sentences.

Activity S5 D

Alternate to S5C

In this activity the children practice writing and solving difference sentences from length situations.

Objectives

1 solves a + b = ☐ sentence 0-20

2 solves a - b = ☐ sentence 0-20

3 writes open + or - sentence 0-20

Materials

Student Booklet page 16 (Part 2)

Student Booklet pages 17 and 18 (Part 3)

paper (Parts 1 and 2)

tape (Part 1)

collection of objects 1-14 inches long (Part 1)

adding machine tape (Part 2) or construction paper

dice (Part 2)

markers (Part 2)

cubes (Part 1)

Preparation

Part 1 Make 10-15 (enough for half the class) circles labeled GUESS, 10-15 circles labeled MEASURE, and 10-15 tags labeled OPERATOR.

Part 2 Cut several lengths of adding machine tape or construction paper each 1-20 links in length.

Teaching Suggestions

As the children write and solve difference sentences, encourage them to think about the reasonableness of their answers and to validate answers by counting or using objects. Have those children who are having difficulty use the part-part-whole chart to analyze. Parts 1 and 2 are active. Part 3 provides Student Booklet pages.

Part 1. Begin by explaining that you have brought a collection of objects to a big company to be measured by the Great Guess-and-Measure machines. Tell the children that they are going to be the machines and the operators of the machines. You may wish to demonstrate how the "machine" works after you have assigned roles and given the children directions.

Set out the pile of objects (about 20) that are between 1 and 20 cubes long. Divide the class into two equal groups and give each child pencil and paper. Give each child in one group, the "machine" group, a GUESS button and a MEASURE button, which are taped, one to each shoulder. Give each child in the other group and operator tag and a rod of 20 cubes.

loop of transparent
tape

GUESS
Button

Have the "machines" line up, not too close to each other. Each "operator" then "runs" a machine by giving it an object from the pile and pushing the GUESS button. The machine guesses the length of the object which the operator records. Then the operator gives the "machine" the rod of 20 cubes and pushes the measure button. The machine measures the length of the object to the nearest cube. Then BOTH the operator and machine write and solve a sentence about the difference between the guess and the measurement. After the operator has "run" 5 machines (each time using a different object), the "machines" and operators change roles and do 5 more sentences. If you do not have an even number of children in your room, play a part yourself.

Part 2. This part presents a game--The Great Guess-and Measure Machine game--that provides opportunities to write and solve difference sentences. Have the children look at the gameboard on Student Booklet page 16. After giving the children the directions on how to play, you may have all the children play (in groups of 2, 3, or 4), or have them come back to this after finishing the pages in Part 3.

Each player needs pencil and paper and a marker. Each group needs a die, 20 links, and a set of strips of adding machine tape or construction paper to measure.

TO PLAY: On his or her turn, the child:

1. Chooses a length of paper or an object to measure.
2. Rolls the die and moves on the Guess path that number of spaces.
3. Measures the paper. (May need help from the other players to hold down the paper in order to measure.)
4. Compares the measurement to the guess he or she landed on. Writes and solves a difference sentence. And scores that number of tally marks.

EXAMPLE:

MARTHA

1. 11 - 4 = $\boxed{7}$ | | | | | | |

2 5 - 0 = $\boxed{5}$ | | | | |

Game ends: When any player reaches the machine shop.

Winner is: Person with fewest number of tally marks.

Alternatives: If a person makes an error in solving, a penalty tally is added to her or his score.

Part 3. In this part the children are given height and distance situations and asked to write and solve sentences.

Student Booklet page 17 uses a graph of height measured in cans.

Student Booklet page 18 uses a map and distance measured in steps.

ACTIVITY S5 E

This activity introduces the separating situation represented by $\square - b = c$, or the part-part-whole sentence, $\boxed{w} - p = p$, where the whole is unknown. The situations introduced in previous sentence writing topics are reviewed also.

Objectives

1 solves $a + b = \square$ sentence 0-20

2 solves $a - b = \square$ sentence 0-20

3 writes open + or - sentence 0-20

Organization

large group

individual

Materials

Student Booklet pages 19 and 20

objects to solve with.

Preparation

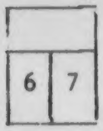
No special preparation.

Teaching Suggestions

This activity reviews those situations that the children had in previous sentence writing topics, and introduces the situation (separating and part-part-whole) where the whole is the unknown.

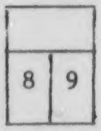
Begin by reading the following stories to the children. Have volunteers draw and fill in a part-part-whole chart for each. Use objects to represent each story. Have the children write a sentence and solve for each story. Then use the objects to validate using the answer and actually doing the action described in the story. For example, to validate Problem 1, suppose 13 is found as the answer. Set out 13 objects to represent the keys. Give six away and count to see if, indeed, seven are left.

1. Brenda collected some old keys. She gave away 6 and had 7 left. How many did she have to start with?



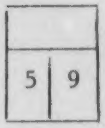
$6 + 7 = \boxed{13}$

2. Oscar lost 8 of his bricks. Then he had 9 left. How many did he have before he lost any?



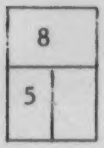
$8 + 9 = \boxed{17}$

3. June had some pails of rain water. Frank took 5 pails of it for his fish. Then June had 9 pails left. How many pails of rain water did she have to start with?



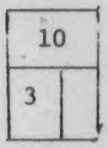
$5 + 9 = \boxed{14}$

4. Gwen lost some of the buttons. She had 8 to start with. Now she has 5. How many did she lose?



$8 - 5 = \boxed{3}$

5. Ronny's chalk was 10 cubes long. After he used it, it was 3 cubes long. How much of it did he use?



$10 - 7 = \boxed{3}$

Do as many other examples as you think necessary. Then introduce Student Booklet pages 19 and 20, where the children fill in the part-part-whole chart, write a sentence and solve.

ACTIVITY S5 F

This activity helps children to organize their thinking so that solving open sentences is easier. It deals with grouping by tens the numbers to be added or subtracted.

Objectives

1 solves $a + b = \square$ sentence 0-20

2 solves $a - b = \square$ sentence 0-20

3 writes open + or - sentence 0-20

Organization

large group and individual

Materials

Student Booklet pages 21-23 (Part 1)

Student Booklet pages 24-26 (Part 2)

objects for use as counters

Preparation

No special preparation

Teaching Suggestions

All children should do Part 1 of this activity, which gives practice in adding and subtracting 10. In Part 2 the use of grouping by tens when adding and subtracting should be introduced only to those children who have good understanding of number. Most children should do the pages on Part 2 simply as further practice on solving 0-20.

Part 1. The Student Booklet pages in this part provide practice solving sentences that involve the relationship of ten to another number. You may wish to do these orally as a group. You can let the children use objects, but encourage them to use them only when they are really stumped.

Page 21. This page gets at two basic questions: "What do you add to a given number to make it equal to 10?" and "What do you take away from a given number to make it equal to 10?"

Page 22. This page presents two other questions: "When you subtract 10 from a given number, what do you get?" and "When you add 10 to a given number, what do you get?"

If the children need more emphasis on the importance and usefulness of ten, given them more sentences like those on pages 21 and 22. A great deal of verbalizing may be needed at this point in the activity.

Those children who do well on 21 and 22 should go on to page 23.

Page 23. This page combines the ideas presented on pages 21 and 22 and presents a few variations, all revolving around relationships of other numbers and ten.

Part 2. In this part you may give the Student Booklet pages 24-26 to all the children as further practice on solving with the numbers 0-20. OR you may present the following ideas and suggestions to those children who understand numbers well.

Keep in mind that the ideas suggested are just that - suggestions. It is not necessary for the child to master any of these methods; thus, you should not plan to spend an inordinate amount of time with them.

The main point of this part is to give the better children a quick way to solve problems by using their knowledge of the relationships between other numbers and ten. Throughout this part you should stress thinking and figuring out the solution without using objects. Ten is seen as the key to this type of problem solving. Either you add up to ten by breaking up the second number:

$$\begin{array}{l} 8 + \underset{(2+5)}{7} = \square \\ (8 + 2) + 5 = \square \\ 10 + 5 = \boxed{15} \end{array}$$

Or you subtract to ten by breaking up the second number:

$$\begin{array}{l} 15 - \underset{(5+2)}{7} = \square \\ (15 - 5) - 2 = \square \\ 10 - 2 = \boxed{8} \end{array}$$

If the children had to write all the steps shown above, however, it would serve only to confuse those who are having trouble and slow down those who know what is going on. Therefore, we recommend that these steps be done either all mentally or in an abbreviated fashion - $\overset{10}{\cancel{8}} + \overset{5}{\cancel{7}} = 15$ for the addition example and $\overset{10}{1\cancel{5}} - \overset{2}{\cancel{7}} = 8$ for the subtraction example.

Page 24. The sentences are grouped to aid in the solution of each other. For example, the first five problems all involve adding another number to eight: each time the child has to add enough to the eight to make it equal ten then add what is left on the second number to ten. Given the problem $8 + 9 = \square$, you might say in a demonstration: "How much do you add to 8 to equal 10?" (2) "So add 2 of the 9 to 8 to make 10. Now since you've already added 2 of the 9, how many of the 9 do you have left to add?" (7) "And 10 plus 7 equals what?" (17) The format of this page should help the children practice adding to ten with the least possible confusion.

Page 25. Open sentences are given that involve subtracting to ten. Once again these sentences are grouped to make it easier for the child to see what is going on. Given the sentence $13 - 7 = \square$, you might say in a demonstration" "What do you have to take away from the 13 to make it equal to 10?" (3) "So if you take away 3 of the 7, how many of the 7 do you have left to take away?" (4) "Ten take away 4 equals what?" (6) Remember to encourage the children to do the type of thinking that you verbalized in the demonstration instead of using objects. Those children who cannot yet think abstractly, however, may have much difficulty solving these problems mentally and should be allowed to use objects. It is doubtful that this method of solving will be very helpful to such children.

Page 26. The children practice adding up to ten or taking away to ten. Make up more such pages at this time if appropriate. Throughout the rest of this topic, encourage the children to solve mentally using this method or the ones described in the next activity.

ACTIVITY S5 G

(formerly 35E)

This activity helps children to organize their thinking so that solving open sentences is easier. It deals with sums and differences involving the number nine and suggests a way to use the doubles facts to help solve problems.

Objective

1 solves $a + b = \square$ sentence 0-20

2 solves $a - b = \square$ sentence 0-20

3 writes open + or - sentence 0-20

Organization

large group and individuals (Parts 1, 2)

Materials

Student Booklet pages 27 and 28 (Part 1)

Student Booklet pages 29 and 30 (Part 2)

objects for use as counters (Parts 1, 2)

Preparation

No special preparation

Teaching Suggestions

Part 1. Student Booklet page 27 provides for guided discovery on the part of the individual child. It asks the child to recognize patterns in the digits of the numbers involved in sums and differences. If you wish, let the children work on their own. If you feel the children would profit from a more direct presentation, have a group demonstration first with children or objects, doing part or all of Student Booklet page 27.

Try to structure your discussion during the demonstration to help the students see the pattern. There are at least two patterns that the children may see:

The sum of nine and another number is always one less than the sum of ten and that number; that is, the ones digit in the sum is always one less than the other number.

If you find the sum of nine and a second one-digit number, and then add the digits of the sum, it will equal the second number; for example, in 9 + 7 = 16, the sum of 1 and 6 is 7.

Use a similar demonstration for subtraction. Again, try to structure the discussion so the children see the pattern of digits.

Page 28. Use this page at the end of the demonstration. It gives practice in both addition and subtraction of nine. Let the children use the counters to solve the problems if they need them.

Part 2. This part suggests a way to use the easily remembered double facts to get answers to other addition and subtraction problems.

For some reason children can usually remember the addition facts associated with the sums 1 + 1, 2 + 2, 3 + 3, . . . 10 + 10 more easily than other addition facts. Use Student Booklet page 29 to review the doubles facts.

After reviewing the facts, show the children how sums of numbers that differ by 1 (such as 4 + 3, 7 + 6, 5 + 6) can be remembered by relating them to the doubles facts. As an example, choose a problem such as 6 + 5. First ask, "What is 5 + 5?" If the answer is forthcoming, try to get the children to see that the answer to 6 + 5 is just one more than the answer to 5 + 5 because six is just one more than five.

Go through several examples, using both the horizontal and the vertical formats. It is recommended that the doubles you use involve the smaller of the two numbers in the original problem. That is, if you are finding 8 + 7 use the seven doubles fact. Student Booklet page 30 asks the children to use the doubles fact to solve other open sentences.

ACTIVTY S5 H (Optional)

This activity provides a variety of games and activities to practice writing and solving sentences.

Objectives

1 solves a + b = sentence 0-20

2 solves a - b = sentence 0-20

3 writes open + or - sentence 0-20

Organization

large group (Parts 1 and 2)

individual (Part 1)

Materials

Student Booklet pages 31, 32, and 33 (Part 1)

paper (Parts 1 and 2)

dice (Parts 1 and 2)

geometric solids (Part 1)

balances and weights (part 1)

2-centimeter graph paper (Part 2)

crayolas (Part 2)

chips (Part 2)

geoboards and rubber bands (Part 2)

cubes (Part 2)

links (Part 2)

containers (Part 2)

Preparation

See Teaching Suggestions for parts you choose to do.

Teaching Suggestions

The first part of this activity presents new games and Student Booklet pages that give practice in writing and solving sentences. The second part reviews games previously done in sentence writing Topics S2, S3, and S4. You may also add any other games or activities you have that practice solving.

This would also be a good time to have children bring in any electronic devices (Dataman, Little Professor, etc.) or electronic games they would like to share.

Do whatever parts of this you feel the children would enjoy and/or benefit from.

Part 1. This part introduces games and activities that practice writing and solving sentences.

The Daily Contest: Beat Wanda Winner. A child plays this with a pair of dice and Student Booklet page 31. He or she tries to score more points than Wanda.

The child rolls the dice and adds the two to get his or her number, which is recorded on page 31. Then the child rolls again and adds to get Wanda's number, which is recorded on page 31. Whoever has the larger number wins. and gets, as a score, the difference between the two numbers. If the numbers are the same, there is no winner. To score, the child writes a difference sentence using his or her number and Wanda's number. The solution is the number of points (tally marks) scored in the appropriate column (ME or WANDA). After nine rounds the tally marks are counted and the winner is the person with the most points.

You may wish to keep a class record of how many times Wanda doesn't win. Children may play this game individually whenever they have time.

Solid Collections. This comparing activity uses the geometric solids, links, and Student Booklet page 32. The children play in pairs.

a) Each child draws 4 solids and counts the number of faces. Then the pair compare answers. Each child writes a sentence about the difference and solves.

b) Each child lays her or his 4 solids end to end and measures the length in links. Then the pair compare lengths. Each child writes a sentence about the difference in length and solves.

c) Each child counts the number of straight edges there are altogether on the solids. They compare and write a sentence about the difference in the number of edges.

d) You may also have the children weigh one solid and compare weights. The children draw four more solids and repeat with a different person.

The Long Story of the Short Sticks. On Student Booklet page 33 the children write a joining or separating sentence for each step of the story. Caution them to do the steps in order and remind them that each answer to a step is used in the next step.

Then have the children write their own story. You may have them write in shortened form.

Had 10

Lost 5

10 - 5 = 5

Found 11

5 + 11 = 16

Lost 14

16 - 14 =

etc.

Pick a number for them to end with.

Part 2. This part contains some review games from previous sentence writing topics. Use these as you think best.

Sentence Bingo. Topic S4, Activity F. Cut 4 x 4 grids from 2-centimeter graph paper. The children play bingo to practice representing and solving open sentences. Give each child three or four 4 x 4 grids (from graph paper) and have him or her write the numbers 0-20 in the squares in random order until all of the squares are filled. Use one of the prepared sets of sentences with solutions 0-20 (see page 33). Tell the children to pick one of their grids for playing this round. Then select one sentence and write it on the board. Each child solves the sentence and colors any square on his or her grids that has the solution. Continue until one child gets four in a row. He or she wins the round. Have the children use a new grid for each round.

This and More. Topic S4, Activity F. Use the grids and strips from preparation in S4 F. (You need pencil, paper, two dice and chips). Use the following on a strip of paper.

3	5	6	7	8	9	10

On your turn roll the two dice. Add the two numbers to get a total. Then decide how many more you would need to have 14. Put a chip over that number on your strip, if it's there.

The winner is the first person to cover all the numbers on the strip.

Variations

A. Use this grid instead of a strip.

2	3	4	5
9	8	7	6
10	11	12	2
3	4	5	6

First person to cover 4 in a row or four in a square is the winner.

3	4
8	7

B. Make the number you have to get be 12 or 13 instead of 14.

The scoring strips and grids would be

for 13

3	4	5	6	7	8	9

1	2	3	4
8	7	6	5
9	10	11	1
2	3	4	5

for 12

2	4	5	6	7	8

0	1	2	3
7	6	5	4
8	0	10	11
2	1	0	12

Geoboard Differences. Topic S3, Activity E. Give each child or each pair of children a geoboard, rubber band and paper.

Have the children make a path on the geoboard with the rubber band. They count the number of pegs the rubber band touches and the number of pegs inside the path the rubber band makes. Then they find the difference between the two numbers. All work is recorded. They then make a new path and do the same for it. Have the children make as many paths as they have time for.

Mystery Container Game. Topic S4, Activity B. Have each child secretly prepare a container by putting 0-10 cubes or links of one color and 0-10 cubes or links of a second color in the container. Containers may have lids or the children may put a hand over the top so that no one else can see into the container.

Give each child a slip of paper with either a + or a -.

Next demonstrate how the game is played.

Children play the game in groups of 4 or 5. Each child in the group gets a turn to be "It." When "It," each child secretly looks at the slip of paper.

If the sign is +, he or she peeks in the container and gives the number of each color, for example, "I have 2 red cubes and 3 blue cubes. How many altogether?" The other children then must tell how many the objects are emptied from the container to check and must decide if the person It asked the "right" question for the sign (+).

If the sign is -, he or she peeks in the container and give the total number of objects and the number of objects of one color. For example, "I have 11 links. 5 links are yellow. How many are blue?" The rest of the children in the group must tell how many objects of the second color (empty the container and count to check) and if the person asked the "right" question for the sign. (-)

Children may prepare new containers for new rounds of play.

SETS OF SENTENCES FOR BINGO

7 - □ = 7
10 - 9 = □
□ + 6 = 8
6 - 3 = □
10 - □ = 6
□ + 3 = 8
9 - 3 = □
20 - □ = 13
13 - □ = 5
4 + 5 = □
□ - 6 = 4

3 + 8 = □
6 + 6 = □
2 + □ = 15
8 + 6 = □
6 + 9 = □
□ - 8 = 8
5 + 12 = □
13 + 5 = □
10 + 9 = □
8 + 12 = □

2 - □ = 2
2 + □ = 3
10 - □ = 8
11 - □ = 8
5 + □ = 9
5 + □ = 10
□ - 5 = 1
12 - 5 = □
11 - 3 = □
17 - 8 = □
□ + 1 = 11

□ - 6 = 5
3 + 9 = □
9 + 4 = □
12 + 2 = □
8 + 7 = □
□ - 6 = 10
11 + 6 = □
9 + 9 = □
11 + 8 = □
□ - 5 = 15

3 - 3 = □
7 - 6 = □
9 - 7 = □
□ + 2 = 5
8 - □ = 4
□ + 4 = 9
1 + 5 = □
3 + 4 = □
□ - 5 = 3
3 + 6 = □
17 - □ = 7

9 + 2 = □
□ - 8 = 4
□ + 1 = 14
□ - 6 = 8
5 + 10 = □
20 - 4 = □
8 + 9 = □
20 - 2 = □
15 + 4 = □
□ - 10 = 10

□ + 18 = 18
5 - □ = 4
15 + □ = 17
12 - □ = 9
9 + □ = 13
12 - 7 = □
9 - □ = 3
3 + □ = 10
□ - 2 = 6
3 + □ = 12
20 - 10 = □

7 + 4 = □
□ - 8 =
6 + 7 = □
7 + 7 = □
□ - 1 = 14
9 + 7 = □
7 + 10 = □
20 - □ = 2
14 + 5 = □
□ - 6 = 14

Topic Inventory S5

You may use this group-administered inventory to:

1. confirm observations you made as the children worked Topics S4 and S5;
2. assess progress if you have not been able to observe a child or if you have doubts about his/her level of mastery.

OBJECTIVES

1 solves a + b = ☐ sentence 0-20
2 solves a - b = ☐ sentence 0-20
3 writes open + or - sentence 0-20

ORGANIZATION

large group

MATERIALS

test pages and pencil for each child
clock you can see for timing page A

DIRECTIONS

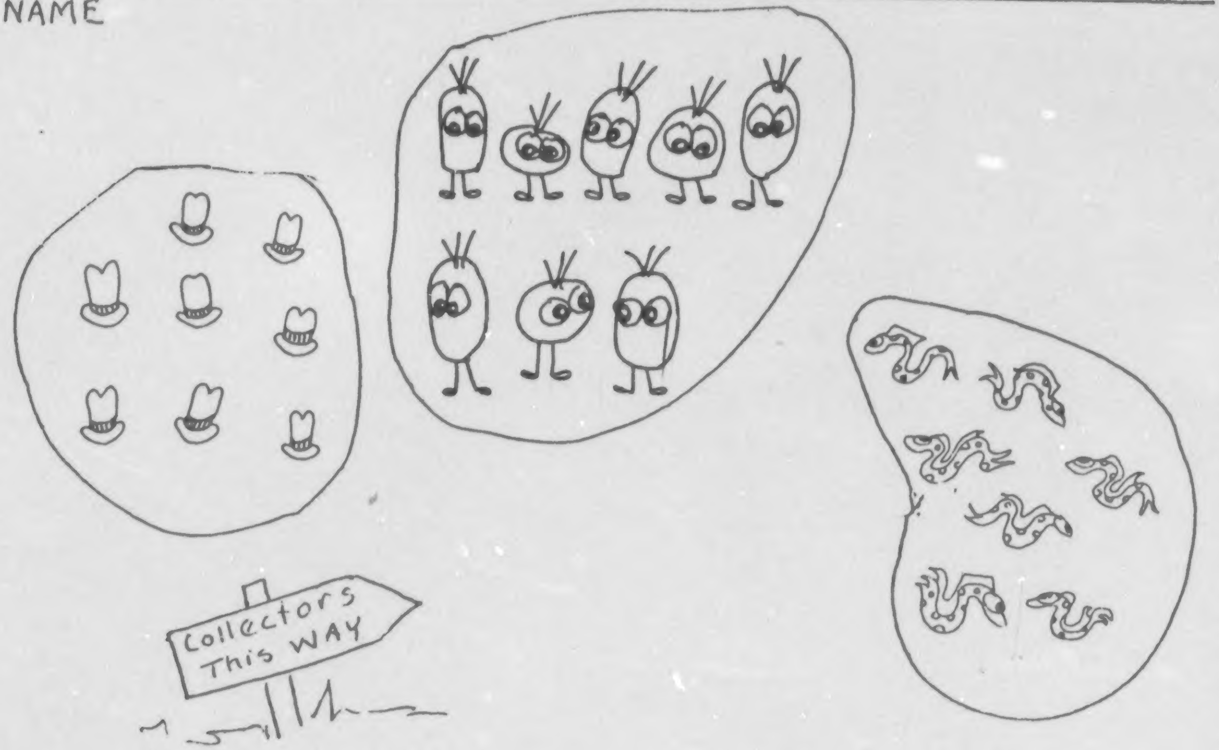
On page A the children solve open sentences in horizontal and vertical form. This should be a time test. Give the children 3 minutes to do all 20 problems.

On page B read each story to the children. They are to fill in the chart, write a sentence, and then solve in vertical form. You may wish to do an example before beginning this part of the inventory.

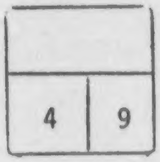
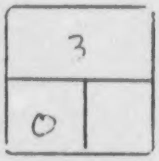
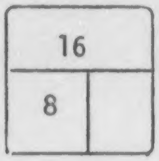
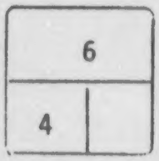
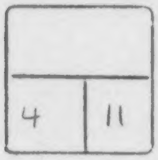
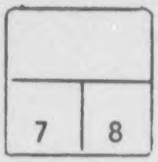
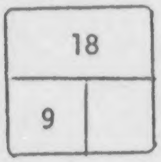
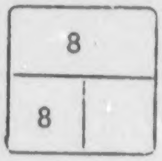
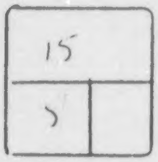
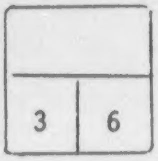
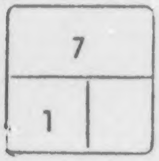
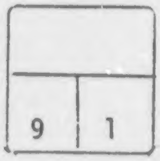
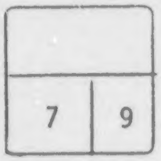
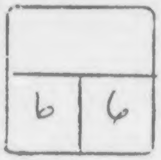
TOPIC S5

Solving Situations and Sentences 0-20

NAME


Collectors
This WAY

FILL IN THE MISSING CHART, SENTENCE, OR VERITCAL FORM. THEN SOLVE.

	chart	sentence	vertical		chart	sentence	vertical
A	EXAMPLE 	4 + 9 = ☐	+9 13	B		3 - 0 = ☐	3 - 0 3
C		16 - 8 = ☐	16 - 8 8	D		6 - 4 = ☐	6 - 4 2
E		4 + 11 = ☐	4 + 11 15	F		7+8 = ☐	7 + 8 15
G		18 - 9 = ☐	18 - 9 9	H		8 - 8 = ☐	8 - 8 0
I		15 - 5 = ☐	15 - 5 10	J		3+6 = ☐	3 + 6 9
K		7 - 1 = ☐	7 - 1 6	L		9+1 = ☐	9 + 1 10
M		7 + 9 = ☐	7 +9 16	N		6 + 6 = ☐	6 + 6 12

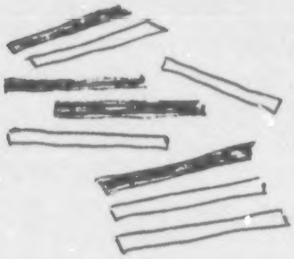
FILL IN THE MISSING CHART, SENTENCE, OR VERTICAL FORM. THEN SOLVE

chart	sentence	vertical	chart	sentence	vertical
A EXAMPLE 8 5	8+5= □	8 +5 13	B 8 2	8 - 2 = □	8 -2 6
C 15 6	15-6= □	15 - 6 9	D 11 2	11-2= □	11 -2 9
E 12 9	12 - 9 = □	12 -9 3	F 9 9	9+9= □	9 +9 18
G 5 9	5+9= □	5 + 9 14	H 10 9	10 - 9 = □	10 -9 1
I 19 10	19-10= □	19 -10 9	J 7 5	7+5= □	7 + 5 12
K 11 11	11-11= □	11 - 11 0	L 1 0	1+0= □	1 +0 1
M 10 0	10 - 0 = □	10 -0 10	N 4 5	4 + 5 = □	4 +5 9

FILL IN THE CHART. WRITE THE SENTENCE WITH THE BOX.
WRITE THE VERTICAL FORM. SOLVE.

4

Collectors
THIS Way.



Boxes and bottles, cans and rings,
We are collectors of wonderful things.
Wagons and yo-yos, leaves and rocks,
Strings and sticks, toys and socks.
Come to our club house any day.
Bring us some things or take some away.

1 17 bottles.
Some are green.
9 are brown.
How many are green?

17	
9	

$$\begin{array}{r} 17 \\ -\ 9 \\ \hline \end{array}$$

$17 - 9 = \boxed{8}$

3 Tina used bricks to weigh a tire.
She used 9 bricks.
Then 8 more bricks.
How many bricks did the tire weigh?

9	8

$$\begin{array}{r} 9 \\ +\ 8 \\ \hline 17 \end{array}$$

$9+8= \boxed{17}$

4 A big can had 16 cups of water in it.
Some of it spilled.
7 cups of water were left.
How much spilled?

16	
7	

$$\begin{array}{r} 16 \\ -\ 7 \\ \hline 9 \end{array}$$

$16-7= \boxed{9}$

6 Joe had a string 16 cubes long.
He used 8 cubes of it.
How much was left?

16	
8	

$$\begin{array}{r} 16 \\ -\ 8 \\ \hline 8 \end{array}$$

$16 - 8 = \boxed{8}$

2 Some bottles
4 are clean.
3 are dirty.
How many bottles in all?

4	3

$$\begin{array}{r} 4 \\ +\ 3 \\ \hline 7 \end{array}$$

$4+3 = \boxed{7}$

5 A string was 5 cubes long.
Some more was tied on.
Then it was 11 cubes long.
How much was tied on?

11	
5	

$$\begin{array}{r} 11 \\ -\ 5 \\ \hline 6 \end{array}$$

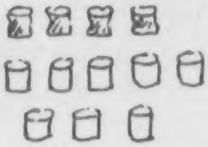
$11-5= \boxed{6}$

MORE CAN COLLECTIONS

5

FILL IN THE CHART. WRITE THE SENTENCE.
WRITE THE VERTICAL FORM. SOLVE.

A.



12 cans
4 are old.
The rest are new.
How many are new?

12	
4	

$12-4=\square$

$$\begin{array}{r} 12 \\ -\ 4 \\ \hline 8 \end{array}$$

B.

I put in 9 canfuls.
How many more should I add
to get 15 canfuls?

15	
9	

$15-9=\square$

$$\begin{array}{r} 15 \\ -\ 9 \\ \hline 6 \end{array}$$

C. Al had some rocks.
He got 7 more.
Then he had 10 rocks.
How many rocks did he have to start with?

10	
7	

$$\begin{array}{r} 10 \\ -\ 7 \\ \hline 3 \end{array}$$

$10-7=\square$

D. Sally has 13 yo-yo's.
How many should she give away
if she wants to have only
7 yo-yo's?

13	
7	

$13-7=\square$

$$\begin{array}{r} 13 \\ -\ 7 \\ \hline 6 \end{array}$$

E. Nan has a big pipe.
Part of it weighs 8 brikcs.
The other part weighs 3 bricks.
How much does the pipe weigh?

8	3

$8+3=\square$

$$\begin{array}{r} 8 \\ +\ 3 \\ \hline 11 \end{array}$$

F. Tina has a string 5 links long.
She uses some.
She has 1 link of string left.
How much did she use?

5	
1	

$5-1=\square$

$$\begin{array}{r} 5 \\ -\ 1 \\ \hline 4 \end{array}$$

G. Mike has 6 oak leaves and
8 elm leaves.
How many leaves does he have
altogether?

6	8

$6+8=\square$

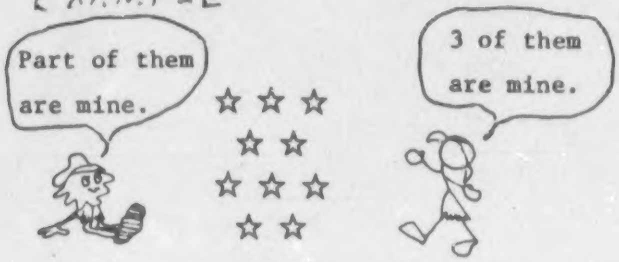
$$\begin{array}{r} 6 \\ +\ 8 \\ \hline 14 \end{array}$$

THE MIXED-UP COLLECTIONS

SOME OF THE COLLECTORS MIXED UP THEIR COLLECTIONS.
HELP THEM SORT THEM OUT. WRITE A SENTENCE FOR EACH.
DRAW A CHART TO HELP. WRITE THE VERTICAL FORM.

EXAMPLE

1.


Part of them are mine.
3 of them are mine.

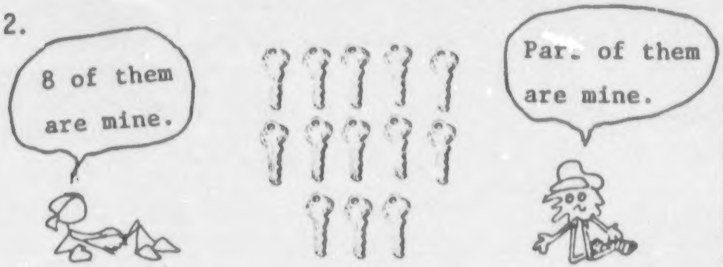
How many are his?

10	
3	

$$\begin{array}{r}10\\-3\\\hline 7\end{array}$$

$10-3=\square$

2.


8 of them are mine.
Part of them are mine.

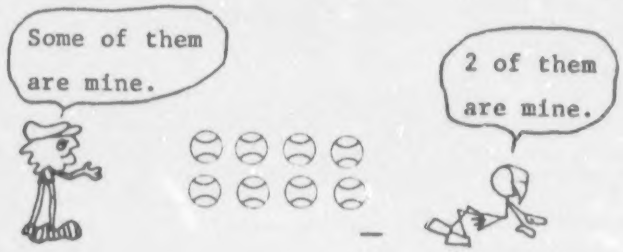
How many are his?

13	
8	

$$\begin{array}{r}13\\-8\\\hline 5\end{array}$$

$13-8=\square$

3.


Some of them are mine.
2 of them are mine.

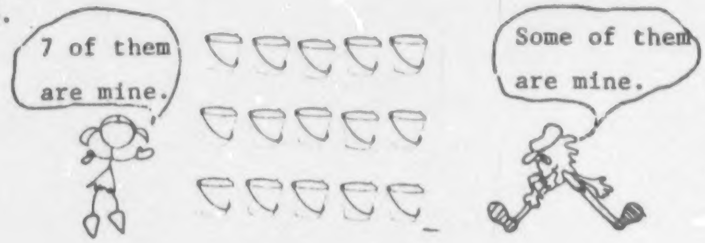
How many are his?

$$\begin{array}{r}8\\-2\\\hline 6\end{array}$$

8	
2	

$8-2=\square$

4.


7 of them are mine.
Some of them are mine.

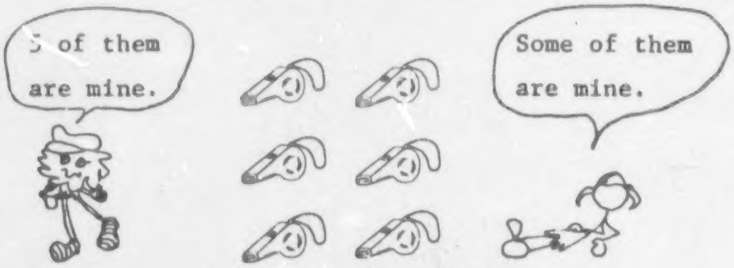
How many are his?

$$\begin{array}{r}15\\-7\\\hline 8\end{array}$$

15	
7	

$15-7=\square$

5.


5 of them are mine.
Some of them are mine.

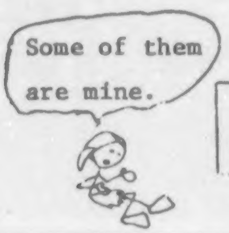
How many are hers?

$$\begin{array}{r}6\\-5\\\hline 1\end{array}$$

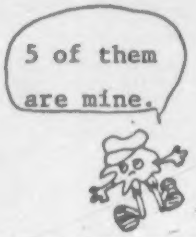
6	
5	

$6-5=\square$

6.


Some of them are mine.

12
caps


5 of them are mine.

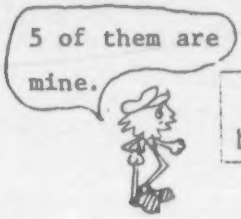
How many are hers?

12	
5	

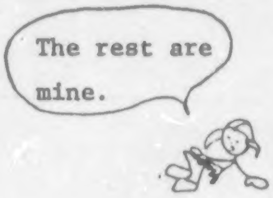
12
− 5
7

12 − 5 = □

7.


5 of them are mine.

14
bugs


The rest are mine.

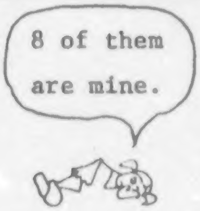
How many are hers?

14	
5	

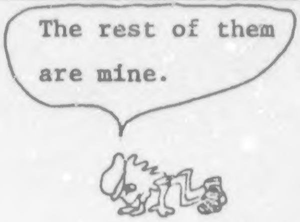
14
− 5
9

14 − 5 = □

8.


8 of them are mine.

19
jars


The rest of them are mine.

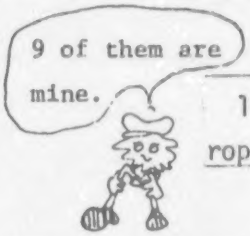
How many are his?

19	
8	

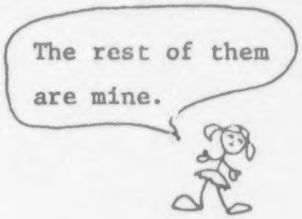
19
− 8
11

19 − 8 = □

9.


9 of them are mine.

16
ropes


The rest of them are mine.

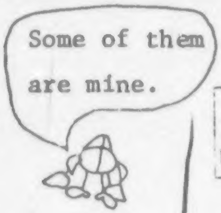
How many are hers?

16	
9	

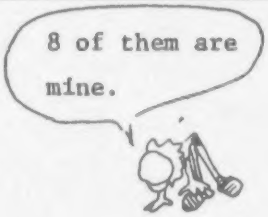
16
− 9
7

16 − 9 = □

10.


Some of them are mine.

14
rocks


8 of them are mine.

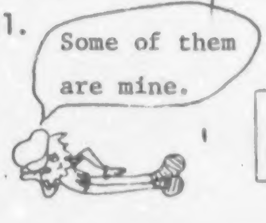
How many are hers?

14	
8	

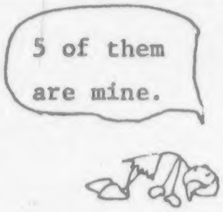
14
− 8
6

14 − 8 = □

11.


Some of them are mine.

7
tires


5 of them are mine.

How many are his?

7	
5	

7
− 5
2

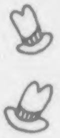
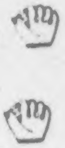
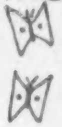
7 − 5 = □

COMPARING COLLECTIONS

8

CIRCLE WHO HAS MORE. HOW MANY MORE?

WRITE A SENTENCE WITH A ☐. SOLVE.

Example [✓ Al 20] Fran 6 20 - 6 = $\boxed{14}$	Amy 13 [✓ Ed 15] 15-13 = $\boxed{2}$	Art 7 [✓ Heidy 9] 9-7 = $\boxed{2}$ 	[✓ Ann 16] Gary 6 16-6 = $\boxed{10}$ 
Betty 3 [✓ Gus 4] 4-3 = $\boxed{1}$	neither Bonnie 10 Lance 10 10-10 = $\boxed{0}$ 	Bert 6 [✓ Nancy 14] 14-6 = $\boxed{8}$	[✓ Bob 14] Megan 13 14-13 = $\boxed{1}$
[✓ Rose 15] Tom 10 15-10 = $\boxed{5}$	[✓ Ron 9] Lisa 3 9-3 = $\boxed{6}$	[✓ Rita 8] Herb 1 8-1 = $\boxed{7}$	[✓ Ray 17] Ellen 8 17-8 = $\boxed{9}$
Steve 7 [✓ Jan 14] 14-7 = $\boxed{7}$	Stan 6 [✓ Lois 13] 13-6 = $\boxed{7}$	[✓ Susan 5] Rich 3 5-3 = $\boxed{2}$	Sonia 0 [✓ Leo 12] 12-0 = $\boxed{12}$
David 4 [✓ Sheri 16] 16-4 = $\boxed{12}$	[✓ Doris 11] Rand 9 11-9 = $\boxed{2}$	[✓ Devin 12] Becky 8 12-8 = $\boxed{4}$	Debbie 9 [✓ Fen 14] 14-9 = $\boxed{5}$
Jenny 1 [✓ Pete 13] 13-1 = $\boxed{12}$	John 2 [✓ Vera 6] 6-2 = $\boxed{4}$	[✓ Jo 7] Kevin 0 7-0 = $\boxed{7}$	[✓ Jackson 10] Char 5 10-5 $\boxed{5}$

BUTTONS, BUTTONS, AND MORE BUTTONS

Circle who has fewer buttons. How many fewer?
Write a sentence with a ☐ . Then solve.

EXAMPLE Franny 7 [✓ Silly 6] $7-6=\boxed{1}$	[✓ Franny 9] Nutty 20 $20-9=\boxed{11}$	[✓ Franny 5] Simon 13 $13-5=\boxed{8}$	Franny 11 [✓ Goofy 6] $11-6=\boxed{5}$
[✓ Martin 3] Franny 6 $6-3=\boxed{3}$	Martin 1 [✓ Silly 0] $1-0=\boxed{1}$	[✓ Martin 10] Goofy 14 $14-10=\boxed{4}$	Martin 19 [✓ Nutty 9] $19-9=\boxed{10}$
[✓ Peep 8] Simon 10 $10-8=\boxed{2}$	[✓ Peep 6] Gertrude 9 $9-6=\boxed{3}$	[✓ Peep 4] Franny 8 $8-4=\boxed{4}$	[✓ Peep 5] Goofy 16 $16-5=\boxed{11}$
[✓ Sally 6] Franny 12 $12-6=\boxed{6}$	Sally 7 [✓ Peep 2] $7-2=\boxed{5}$	Sally 11 [✓ Nutty 7] $11-7=\boxed{4}$	Sally 0 neither Goofy 0 $0-0=\boxed{0}$
Simon 13 neither Nutty 13 $13-13=\boxed{0}$	[✓ Simon 0] Silly 4 $4-0=\boxed{4}$	Simon 11 [✓ Goofy 1] $11-1=\boxed{10}$	[✓ Simon 7] Martin 9 $9-7=\boxed{2}$

FOR EACH STORY, WRITE A SENTENCE WITH A BOX. THEN SOLVE.
USE A CHART IF YOU NEED HELP.

---

1. Tim has 13 bags.
Jill has 9 bags.
How many more bags
does Tim have than Jill?

13	
9	

$13 - 9 = \square$

$$\begin{array}{r}13\\-9\\\hline 4\end{array}$$

---

2. Ned has 7 keys.
Alice has 12 keys.
How many more keys does
Alice have than Ned?

12	
7	

$12 - 7 = \square$

$$\begin{array}{r}12\\-7\\\hline 5\end{array}$$

---

3. Cleo has 15 pins.
Mike has 6 pins.
How many fewer pins
does Mike have than Cleo?

15	
6	

$15 - 6 = \square$

$$\begin{array}{r}15\\-6\\\hline 9\end{array}$$

---

4. Bud has 3 rings.
Paula has 11 rings.
How many fewer rings does
Bud have than Paula?

11	
3	

$11 - 3 = \square$

$$\begin{array}{r}11\\-3\\\hline 8\end{array}$$

---

5. Owen has 9 bottles.
Teri has 4 bottles.
What is the difference in
the number of bottles
Owen and Teri have?

9	
4	

$9 - 4 = \square$

$$\begin{array}{r}9\\-4\\\hline 5\end{array}$$

---

6. Toby gave away 6 seeds.
Karen gave away 11 seeds.
How many more seeds did
Karen give away than Toby?

11	
6	

$11 - 6 = \square$

$$\begin{array}{r}11\\-6\\\hline 5\end{array}$$

---

7. Judd has 1 pencil.
Carrie has 10 pencils.
What is the difference in the
number of pencils Judd and Carrie have?

10	
1	

$10 - 1 = \square$

$$\begin{array}{r}10\\-1\\\hline 9\end{array}$$

WEIGHT RECORD SHEET

ans. will vary

LETTERS Write the letters of the objects.		GUESS In your hands compare the objects and guess the the difference in weight.	WEIGHTS Weigh each object. Use small washers.		SENTENCE Write a sentence about the difference in weight and solve.
1st object	2nd object		1st object	2nd object	
EXAMPLE A	B	4 washers	6	12	$12 - 6 = \boxed{6}$

✪ Questions:

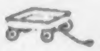
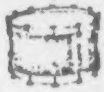
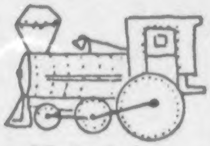
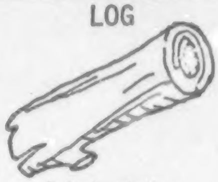
1. Of all the objects that you weighed, which one weighed the most? ________ letter ________ weight

2. Of all the objects you weighed, which one weighed the least? ________ letter ________ weight

3. Write and solve a sentence about the difference in weight between the heaviest object and the lightest object.

____

370 I used small bricks to weigh my collection of objects. Use these weights to answer the questions. For each question write and solve a sentence.

WAGON  13 bricks	CAT 8 bricks	DRUM  7 bricks	TRAIN  15 bricks	CHAIR 16 bricks
BOAT 9 bricks	PAIL 6 bricks	LOG  14 bricks	CAR 12 bricks	SHOE 4 bricks

EXAMPLE

1. How much more does the LOG weigh than the BOAT? $14 - 9 = \boxed{5}$
2. How much less does the SHOE weigh than the CAT? $8 - 4 = \boxed{4}$ bricks
3. What is the difference between the weight of the CHAIR and the weight of the PAIL? $16 - 6 = \boxed{10}$
4. How much do the DRUM and the WAGON weigh together? $7 + 13 = \boxed{20}$
5. How many more bricks would you have to put with the SHOE to make it weigh as much as the DRUM? $7 - 4 = \boxed{3}$
6. How much more does the CAR weigh than the DRUM? $12 - 7 = \boxed{5}$
7. How much weight would the CAT have to lose to weigh as much as the PAIL? $8 - 6 = \boxed{2}$
8. How much less does the SHOE weigh than the BOAT? $9 - 4 = \boxed{5}$

Write a sentence with a ☐. Then solve.

1. How much more does the WAGON weigh than the CAT? $13-8=\boxed{5}$ bricks

2. How much less does the CAT weigh than the TRAIN? $15-8=\boxed{7}$ bricks

3. How much more does the TRAIN weigh than the WAGON? $15-13=\boxed{2}$ bricks

4. How much less does the WAGON weigh than the CHAIR? $16-13=\boxed{3}$ bricks

5. How many bricks would you have to add to the BOAT to have it weigh as much as the WAGON? $13-9=\boxed{4}$ bricks

6. What is the difference in weight between the TRAIN and the CHAIR? $16-15=\boxed{1}$ brick

7. How much do the CAT and DRUM weigh together? $8+7=\boxed{15}$ bricks

8. How much less does the SHOE weigh than the CAR? $12-4=\boxed{8}$ bricks

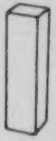
9. What is the difference in weight between the LOG and the DRUM? $14-7=\boxed{7}$ bricks

10. How much do the CHAIR and the SHOE weigh together? $16+4=\boxed{20}$ bricks

MADE OF WOOD, METAL, AND PLASTIC

CIRCLE WHICH WEIGHS MORE. THEN WRITE A SENTENCE THAT SHOWS HOW TO FIND HOW MUCH MORE. SOLVE.

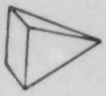
EXAMPLE



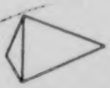
A 6 cubes

[✓ I 17 cubes]

$17-6=\boxed{11}$



B 8 washers



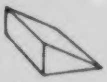
[✓ J 11 washers]

$11-8=\boxed{3}$

C 7 bricks

[✓ K 13 bricks]

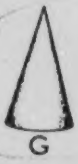
$13-7=\boxed{6}$



F 6 washers

[✓ N 10 washers]

$10-6=\boxed{4}$



[✓ G 13 cubes]

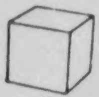
O 10 cubes

$13-10=\boxed{3}$

E 10 bricks.

[✓ M 12 bricks]

$12-10=\boxed{2}$

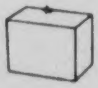


D 5 bricks

[✓ L 8 bricks]

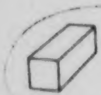
$8-5=\boxed{3}$

H 11 bricks



[✓ P 16 bricks]

$16-11=\boxed{5}$



[✓ A 12 cubes]

I 9 cubes

$12-9=\boxed{3}$

MORE WOOD, METAL, AND PLASTIC OBJECTS

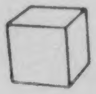
CIRCLE THE LIGHTER OBJECT. HOW MUCH LIGHTER?
WRITE A SENTENCE AND SOLVE.

EXAMPLE

[✓ B 4 cubes]

C 10 cubes

$10 - 4 = \boxed{6}$


D 12 bricks

[✓ E 3 bricks]

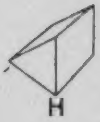
$12 - 3 = \boxed{9}$

F 9 washers

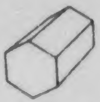
[✓ G 2 washers]

$9 - 2 = \boxed{7}$

[✓ J 0 washers]

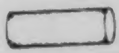

H 6 washers

$6 - 0 = \boxed{6}$


K 14 cubes

[✓ L 11 cubes]

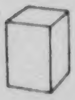
$14 - 11 = \boxed{3}$


N 14 bricks

[✓ W 4 bricks]

$14 - 4 = \boxed{10}$

[✓ O 8 bricks]

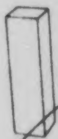

P 13 bricks

$13 - 8 = \boxed{5}$

[✓ E 6 washers]

F 11 washers

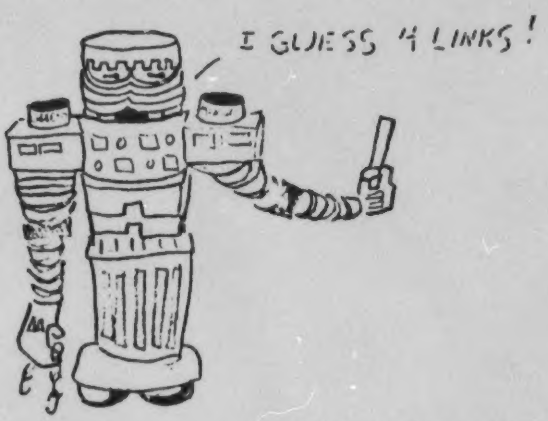
$11 - 6 = \boxed{5}$


A 15 cubes

[✓ L 9 cubes]

$15 - 9 = \boxed{6}$

The Great Guess-and-Measure Machine


I GUESS 4 LINKS!

A GAME FOR 2 - 4 PLAYERS

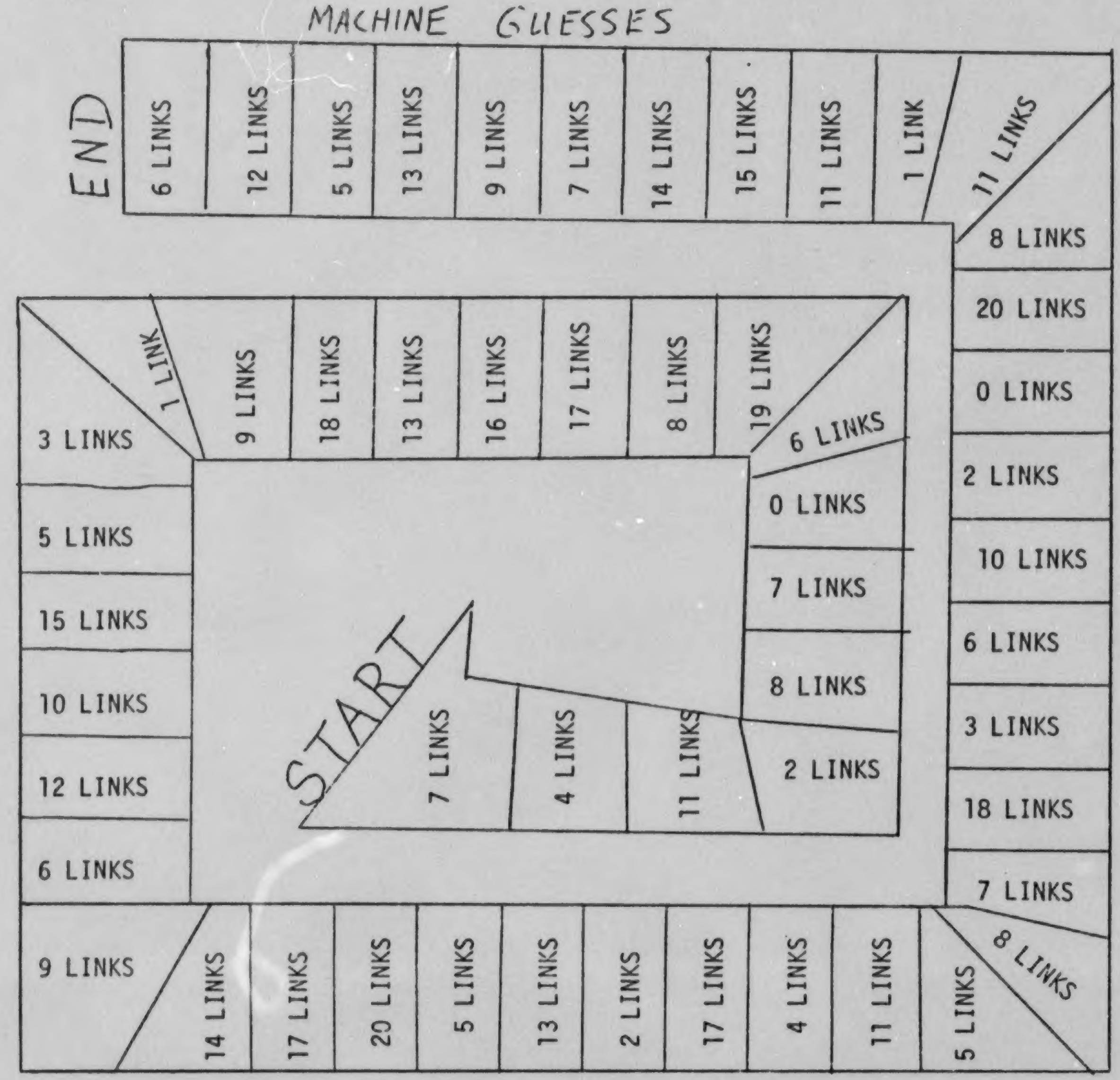
EACH PLAYER WILL NEED:

20 links
a marker
paper and pencil

YOU WILL ALSO NEED:

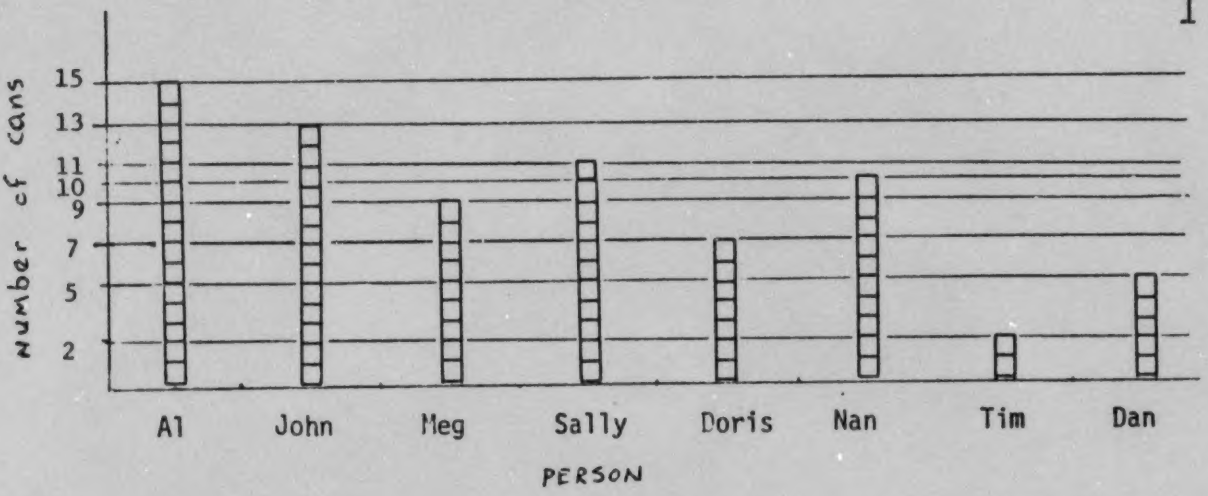
a collection of adding machine tapes

YOUR TEACHER WILL TELL YOU HOW TO PLAY.

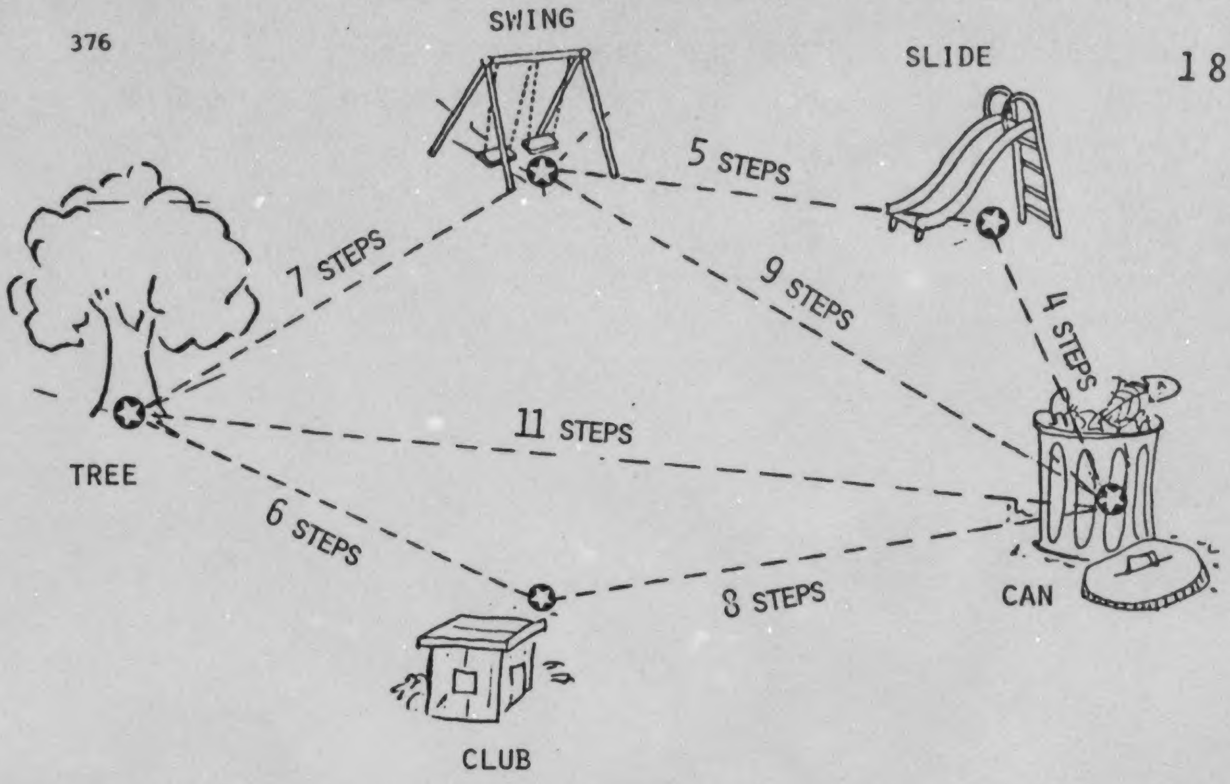

MACHINE GUESSES
START
7 LINKS
4 LINKS
11 LINKS
2 LINKS
8 LINKS
7 LINKS
0 LINKS
6 LINKS
19 LINKS
8 LINKS
17 LINKS
16 LINKS
13 LINKS
18 LINKS
9 LINKS
1 LINK
3 LINKS
5 LINKS
15 LINKS
10 LINKS
12 LINKS
6 LINKS
9 LINKS
14 LINKS
17 LINKS
20 LINKS
5 LINKS
13 LINKS
2 LINKS
17 LINKS
4 LINKS
11 LINKS
5 LINKS
8 LINKS
7 LINKS
18 LINKS
3 LINKS
6 LINKS
10 LINKS
2 LINKS
0 LINKS
20 LINKS
8 LINKS
11 LINKS
1 LINK
11 LINKS
15 LINKS
14 LINKS
7 LINKS
9 LINKS
13 LINKS
5 LINKS
12 LINKS
6 LINKS
END

THE CHILDREN IN THE COLLECTION CLUB STACKED CANS TO MEASURE THE HEIGHT OF THEIR PETS. THEY DREW THIS GRAPH ON THEIR WALL. USE IT TO ANSWER THE QUESTIONS. WRITE AND SOLVE A SENTENCE FOR EACH QUESTION.

17



1. How much taller is Al's pet than Tim's? 15 - 2 = $\boxed{13}$ cans
2. How much does Dan's pet have to grow to be as tall as Sally's pet? 11 - 5 = $\boxed{6}$ cans
3. How tall would the stack of cans be if Dan's pet stood on top of Doris's pet? 7 + 5 = $\boxed{12}$ cans
4. How much shorter is Meg's pet than Sally's? 11 - 9 = $\boxed{2}$ cans
5. What is the difference in height between John's pet and Nan's pet? 13 - 10 = $\boxed{3}$ cans
6. If Dan's pet grew 9 more cans taller, how tall would it be then? 5 + 9 = $\boxed{14}$ cans
7. How much taller is Al's pet than Meg's? 15 - 9 = $\boxed{6}$ cans
8. How much would Doris's pet have to grow to be as tall as John's pet? 13 - 7 = $\boxed{6}$ cans
9. What is the difference in height between Nan's pet and Tim's pet? 10 - 2 = $\boxed{8}$ cans
10. How much shorter is Doris's pet than Al's? 15 - 7 = $\boxed{8}$ cans



Write a sentence for each story and solve.

1. Jo walked from the TREE to the CAN. Hank walked from the TREE to the CLUB.
   How much farther did Jo walk than Hank? $11 - 6 = \boxed{5}$ steps

2. Kim walked from the SWING to the CAN and then from the CAN to the CLUB.
   How far did she walk altogether? $9 + 8 = \boxed{17}$ steps

3. Bert walked from the CLUB to the TREE and then from the TREE to the SWING.
   How far did Bert walk? $6 + 7 = \boxed{13}$ steps

4. Ann walked from the SWING to the CAN. Jack walked from the SLIDE to the CAN.
   How many fewer steps did Jack walk than Ann? $9 - 4 = \boxed{5}$ steps

5. How much farther is it from the CAN to the TREE than from the SLIDE to the SWING? $11 - 5 = \boxed{6}$ steps

6. I walked from the TREE to the SWING and then from the SWING to the CAN.
   How far did I walk? $7 + 9 = \boxed{16}$ steps

I had some cards.
I lost 6.
I have 7 left.
How many did I have to start with?

<table><tr><td colspan="2"></td></tr><tr><td>6</td><td>7</td></tr></table>

$6+7=\square$ $\quad \begin{array}{r}6\\+7\\\hline 13\end{array}$

I had 12 balls.
I gave some away.
I have 5 left.
How many did I give away?

<table><tr><td colspan="2">12</td></tr><tr><td>5</td><td></td></tr></table>

$12-5=\square$ $\quad \begin{array}{r}12\\-5\\\hline 7\end{array}$

I had 14 pennies.
I gave 5 away.
How many do I have left?

<table><tr><td colspan="2">14</td></tr><tr><td>5</td><td></td></tr></table>

$14-5=\square$ $\quad \begin{array}{r}14\\-5\\\hline 9\end{array}$

I had some kites.
I got 6 more.
Now I have 11.
How many did I have to start with?

<table><tr><td colspan="2">11</td></tr><tr><td>6</td><td></td></tr></table>

$11-6=\square$ $\quad \begin{array}{r}11\\-6\\\hline 5\end{array}$

I had 16 ropes.
I lost some.
I have 9 left.
How many did I lose?

<table><tr><td colspan="2">16</td></tr><tr><td>9</td><td></td></tr></table>

$16-9=\square$ $\quad \begin{array}{r}16\\-9\\\hline 7\end{array}$

I had 12 bikes.
I got 4 more.
How many do I have now?

<table><tr><td colspan="2">~~4~~</td></tr><tr><td>12</td><td>4</td></tr></table>

$12+4=\square$ $\quad \begin{array}{r}12\\+4\\\hline 16\end{array}$

I had some rocks.
Jan gave me 6 more.
Now I have 9.
How many did I have to start with?

<table><tr><td colspan="2">9</td></tr><tr><td>6</td><td></td></tr></table>

$9-6=\square$ $\quad \begin{array}{r}9\\-6\\\hline 3\end{array}$

I had some mice.
8 ran away.
I have 4 left.
How many did I have to start with?

<table><tr><td colspan="2"></td></tr><tr><td>8</td><td>4</td></tr></table>

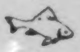
$8+4=\square$ $\quad \begin{array}{r}8\\+4\\\hline 12\end{array}$

ANIMAL COLLECTIONS

378

WRITE A SENTENCE. USE THE CHART TO HELP. THEN SOLVE.

20

20 

Some swim away.
14 are left.
How many swam away?

20	
14	

$20-14=\boxed{6}$

Some

8 more come.
Now there are 11.
How many were there
to start with?

11	
8	

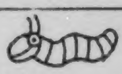
$11-8=\boxed{3}$

15

7 hopped away.
How many are left?

15	
7	

$15-7=\boxed{8}$

6 

Some more come.
Now there are 13.
How many came?

13	
6	

$13-6=\boxed{7}$

Some

8 jumped away.
4 are left.
How many were there to start
with?

8	4

$8+4=\boxed{12}$

15

5 more come.
How many altogether?

15	
5	

$15-5=\boxed{10}$

Some

8 go away.
There are 11 left.
How many were there
to start with?

8	11

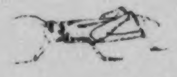
$8+11=\boxed{19}$

Some

are joined by 7 more cows.
Now there are 9.
Now many cows were there
to start with?

9	
7	

$9-7=\boxed{2}$

10 

Some hop away.

2 are left.

How many hopped away?

10	
2	

$10-2=\boxed{8}$

19

One more came.

How many are there now?

19	
1	

$19-1=\boxed{18}$

5

Some more come.

Now there are 13.

How many came?

13	
5	

$13-5=\boxed{8}$

7

5 go away.

How many are left?

7	
5	

$7-5=\boxed{2}$

10 is a Special Number

$7 + \boxed{3} = 10$

$\boxed{8} + 2 = 10$

$9 + \boxed{1} = 10$

$4 + \boxed{6} = 10$

$\boxed{5} + 5 = 10$

$1 + \boxed{9} = 10$

$3 + \boxed{7} = 10$

$17 - \boxed{7} = 10$

$19 - \boxed{9} = 10$

$14 - \boxed{4} = 10$

$16 - \boxed{6} = 10$

$18 - \boxed{8} = 10$

$13 - \boxed{3} = 10$

$11 - \boxed{1} = 10$

$12 - \boxed{2} = 10$

$15 - \boxed{5} = 10$

10 is a very Special Number

10 + 6 = 16

10 + 2 = 12

10 + 4 = 14

10 + 3 = 13

10 + 7 = 17

10 + 5 = 15

10 + 8 = 18

9 + 10 = 19

1 + 10 = 11

19 − 10 = 9

16 − 10 = 6

13 − 10 = 3

15 − 10 = 5

17 − 10 = 7

11 − 10 = 1

12 − 10 = 2

14 − 10 = 4

18 − 10 = 8

20 − 10 = 10

Solve these sentences. Watch for the 10's! 2 3

$\boxed{3} + 10 = 13$

$17 - \boxed{10} = 7$

$15 = 5 + \boxed{10}$

$\boxed{16} - 6 = 10$

$5 + 5 = \boxed{10}$

$9 = 10 - \boxed{1}$

$14 = 4 + \boxed{10}$

$\boxed{7} + 3 = 10$

$\boxed{18} - 10 = 8$

$4 = \boxed{10} - 6$

$19 - \boxed{10} = 9$

$\boxed{10} + 4 = 14$

$10 = \boxed{12} - 2$

$1 + \boxed{9} = 10$

$16 - \boxed{10} = 6$

$11 = 10 + \boxed{1}$

solve

24

$8+7=\boxed{15}$

$8+9=\boxed{17}$

$8+3=\boxed{11}$

$8+4=\boxed{12}$

$8+8=\boxed{16}$

$9+6=\boxed{15}$

$9+2=\boxed{11}$

$9+8=\boxed{17}$

$9+5=\boxed{14}$

$9+7=\boxed{16}$

$7+4=\boxed{11}$

$7+8=\boxed{15}$

$7+5=\boxed{12}$

$7+9=\boxed{16}$

$7+6=\boxed{13}$

$6+8=\boxed{14}$

$6+9=\boxed{15}$

$6+5=\boxed{11}$

$6+6=\boxed{12}$

$6+7=\boxed{13}$

solve

13−7 = 6

13−4 = 9

13−9 = 4

13−6 = 7

13−8 = 5

16−8 = 8

16−7 = 9

16−9 = 7

16−6 = 10

16−4 = 12

14−8 = 6

14−9 = 5

14−5 = 9

14−7 = 7

14−6 = 8

15−8 = 7

15−6 = 9

15−9 = 6

15−7 = 8

15−5 = 10

Solve the sentences.

26

9+3 = $\boxed{12}$

15−9 = $\boxed{6}$

7+9 = $\boxed{16}$

8+6 = $\boxed{14}$

15−8 = $\boxed{7}$

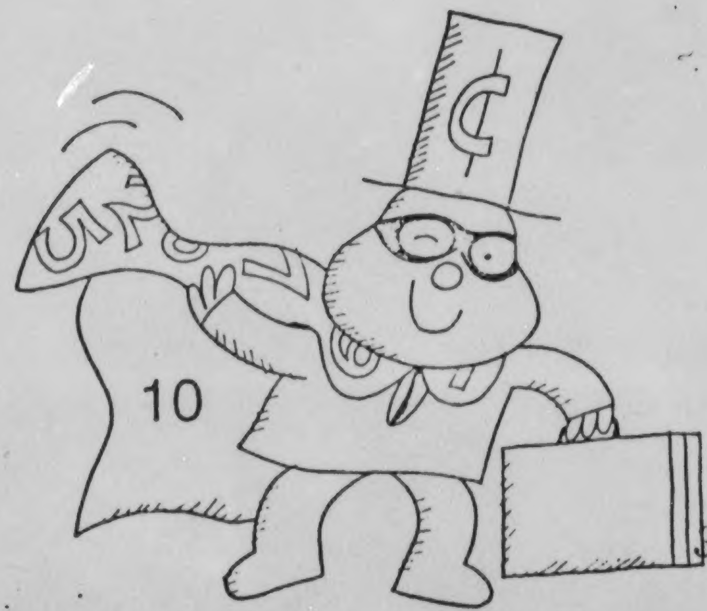
17−9 = $\boxed{8}$

11−6 = $\boxed{5}$

13−4 = $\boxed{9}$

8+4 = $\boxed{12}$

5+7 = $\boxed{12}$



$\begin{array}{r}6\\+7\\\hline 13\end{array}$ $\quad$ $\begin{array}{r}14\\-7\\\hline 7\end{array}$ $\quad$ $\begin{array}{r}3\\+8\\\hline 11\end{array}$

$\begin{array}{r}11\\-3\\\hline 8\end{array}$ $\quad$ $\begin{array}{r}9\\+5\\\hline 14\end{array}$

Miss Nellie Nine has a useful secret.
Solve these sentences, and see if you discover it.

9+0 = 9

9+1 = 10

9+2 = 11

9+3 = 12

9+4 = 13

9+5 = 14

9+6 = 15

9+7 = 16

9+8 = 17

9+9 = 18

9+10 = 19

9+11 = 20

20−9 = 11

19−9 = 10

18−9 = 9

17−9 = 8

16−9 = 7

15−9 = 6

14−9 = 5

13−9 = 4

12−9 = 3

11−9 = 2

10−9 = 1

9−9 = 0

Hello again!

Use Miss Nellie Nine's secret to solve these sentences.

$20-9=\boxed{11}$ $10-9=\boxed{1}$ $1+9=\boxed{10}$

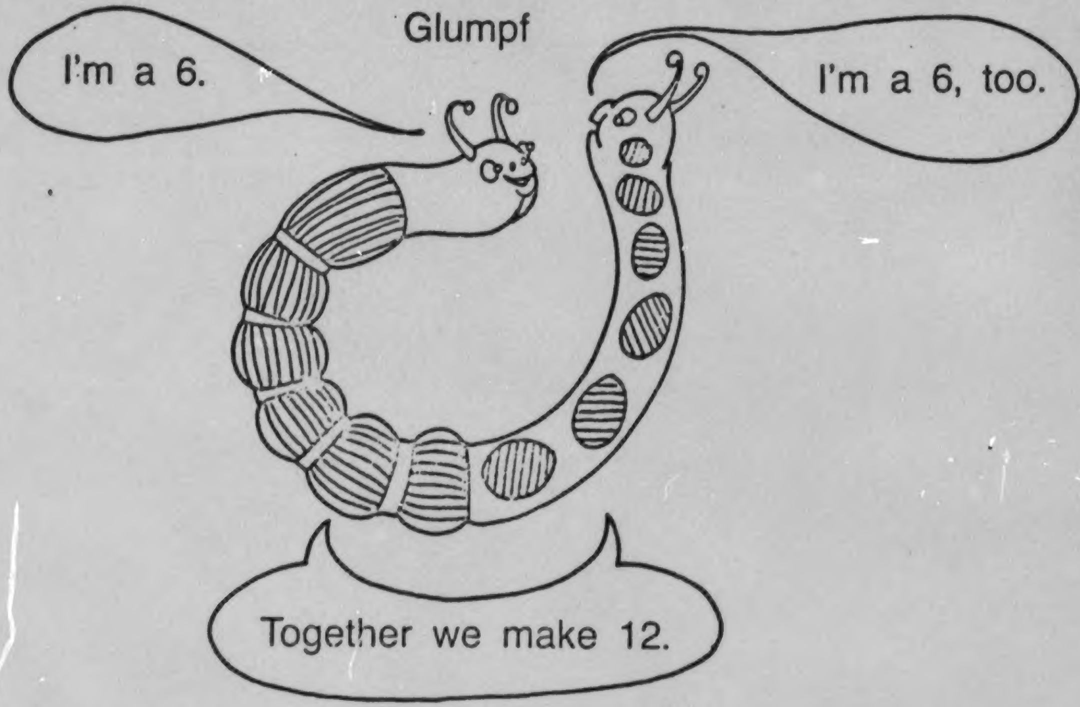
$17-9=\boxed{8}$ $10+9=\boxed{19}$ $9+3=\boxed{12}$

$5+9=\boxed{14}$ $14-9=\boxed{5}$ $19-9=\boxed{10}$

$\begin{array}{r} 9\\ +4\\ \hline 13\end{array}$ $\begin{array}{r} 15\\ -9\\ \hline 6\end{array}$ $\begin{array}{r} 11\\ -9\\ \hline 2\end{array}$ $\begin{array}{r} 7\\ +9\\ \hline 16\end{array}$ $\begin{array}{r} 9\\ +8\\ \hline 17\end{array}$

$\begin{array}{r} 12\\ -9\\ \hline 3\end{array}$ $\begin{array}{r} 18\\ -9\\ \hline 9\end{array}$ $\begin{array}{r} 6\\ +9\\ \hline 15\end{array}$ $\begin{array}{r} 9\\ +2\\ \hline 11\end{array}$ $\begin{array}{r} 13\\ -9\\ \hline 4\end{array}$

Glumpf


I'm a 6.
I'm a 6, too.
Together we make 12.

Solve these sentences.

$4+4=\boxed{8}$

$8+8=\boxed{16}$

$3+3=\boxed{9}$

$9+9=\boxed{18}$

$1+1=\boxed{2}$

$0+0=\boxed{0}$

$5+5=\boxed{10}$

$2+2=\boxed{4}$

$6+6=\boxed{12}$

$7+7=\boxed{14}$

$10+10=\boxed{20}$

Use the doubles to help you.

$$\begin{array}{r} 8 \\ +7 \\ \hline 15 \end{array} \qquad \begin{array}{r} 18 \\ -9 \\ \hline 9 \end{array} \qquad \begin{array}{r} 5 \\ +6 \\ \hline 11 \end{array} \qquad \begin{array}{r} 14 \\ -7 \\ \hline 7 \end{array}$$

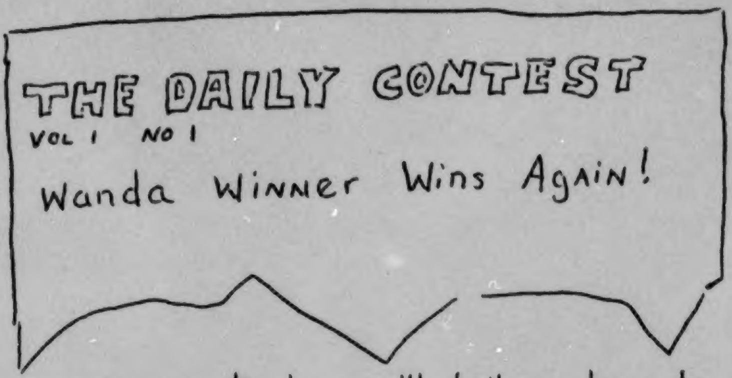
$$\begin{array}{r} 9 \\ +8 \\ \hline 17 \end{array} \qquad \begin{array}{r} 6 \\ +7 \\ \hline 13 \end{array} \qquad \begin{array}{r} 16 \\ -8 \\ \hline 8 \end{array} \qquad \begin{array}{r} 9 \\ +10 \\ \hline 19 \end{array}$$

$$\begin{array}{r} 12 \\ -6 \\ \hline 6 \end{array} \qquad \begin{array}{r} 7 \\ +8 \\ \hline 15 \end{array} \qquad \begin{array}{r} 8 \\ +9 \\ \hline 17 \end{array} \qquad \begin{array}{r} 10 \\ -5 \\ \hline 5 \end{array}$$

$$\begin{array}{r} 7 \\ +6 \\ \hline 13 \end{array} \qquad \begin{array}{r} 20 \\ -10 \\ \hline 10 \end{array} \qquad \begin{array}{r} 4 \\ +5 \\ \hline 9 \end{array} \qquad \begin{array}{r} 4 \\ +3 \\ \hline 7 \end{array}$$

$$\begin{array}{r} 8 \\ -4 \\ \hline 4 \end{array} \qquad \begin{array}{r} 6 \\ +5 \\ \hline 11 \end{array} \qquad \begin{array}{r} 10 \\ +9 \\ \hline 19 \end{array} \qquad \begin{array}{r} 6 \\ -3 \\ \hline 3 \end{array}$$

answers vary


THE DAILY CONTEST
VOL 1 NO 1
Wanda Winner Wins Again!

Can you beat me?

Your teacher will tell you how to play.

MY NUMBER	WANDA'S NUMBER	DIFFERENCE SENTENCE	SCORE	
			ME	WANDA
		TOTAL		

SOLID COLLECTIONS

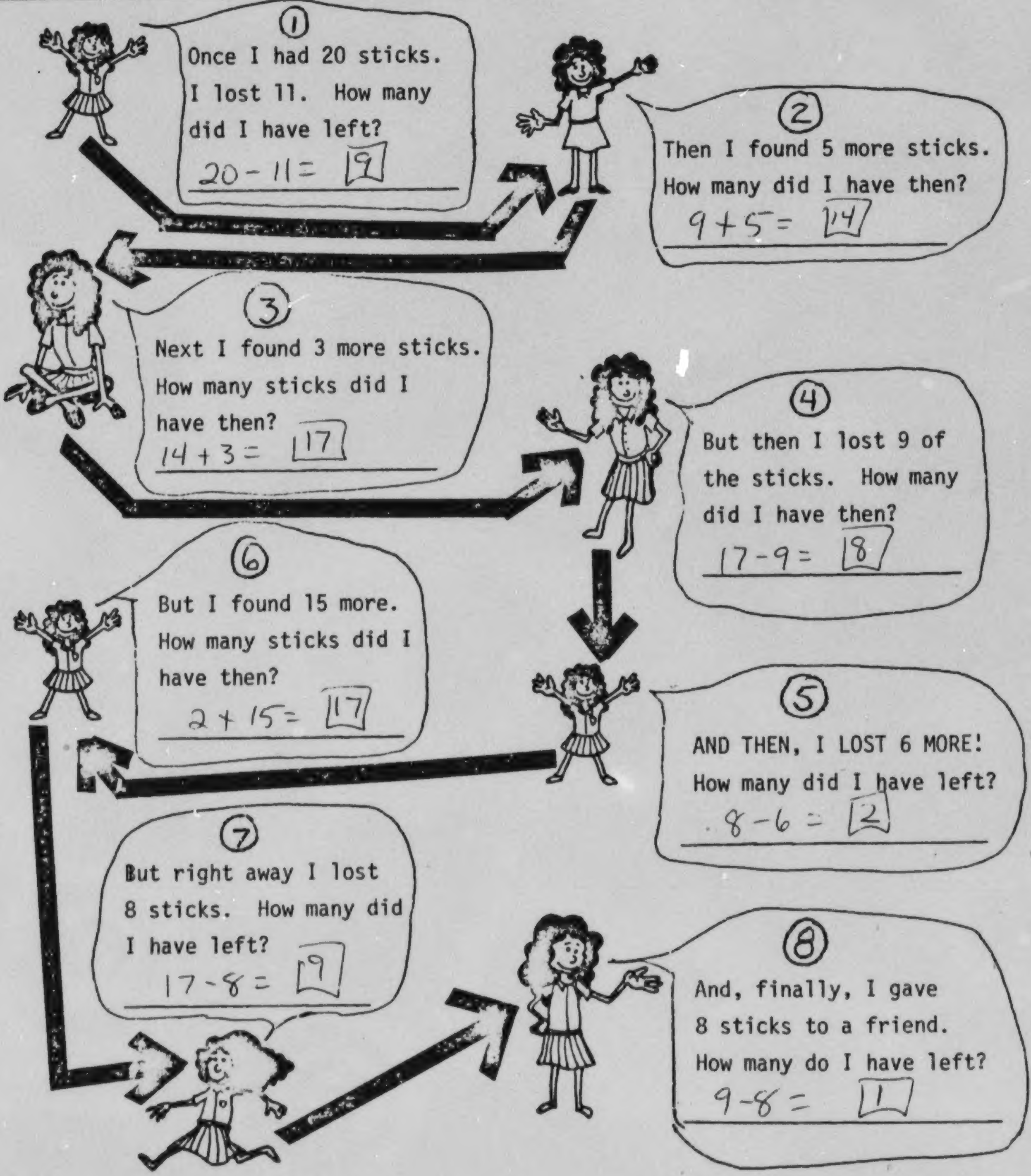
answers vary 3 2

SET 1	My number	Friend's Number	Sentence
a Faces			
b Length			
c edges			
d			

SET 2	My Number	Friend's Number	Sentence
a Faces			
b Length			
c Edges			
d			

THE LONG STORY OF THE short STICKS

Write a sentence for each step of the story. Then solve. You may use counting sticks to help.



① Once I had 20 sticks. I lost 11. How many did I have left?

$20 - 11 = \boxed{9}$

② Then I found 5 more sticks. How many did I have then?

$9 + 5 = \boxed{14}$

③ Next I found 3 more sticks. How many sticks did I have then?

$14 + 3 = \boxed{17}$

④ But then I lost 9 of the sticks. How many did I have then?

$17 - 9 = \boxed{8}$

⑤ AND THEN, I LOST 6 MORE! How many did I have left?

$8 - 6 = \boxed{2}$

⑥ But I found 15 more. How many sticks did I have then?

$2 + 15 = \boxed{17}$

⑦ But right away I lost 8 sticks. How many did I have left?

$17 - 8 = \boxed{9}$

⑧ And, finally, I gave 8 sticks to a friend. How many do I have left?

$9 - 8 = \boxed{1}$

APPENDIX F

TOPIC S-6: MASTERING WRITING AND SOLVING SENTENCES 0-20

TOPIC S6 MASTERING WRITING AND SOLVING SENTENCES 0-20

OBJECTIVES

Regular

1. Given an open sentence of the form $a + b = \square$ or $\begin{array}{r} a \\ \underline{+b} \end{array}$ involving the numbers 0-20, solves it. (solves $a + b = \square$ sentence 0-20)
2. Given an open sentence of the form $a - b = \square$ or $\begin{array}{r} a \\ \underline{-b} \end{array}$ involving the numbers 0-20, solves it. (solves $a - b = \square$ sentence 0-20)
3. Given an open problem situation involving the numbers 0-20 that is solvable by using either addition or subtraction, writes a sentence that represents that situation. (writes open + or - sentence 0-20)

Preparatory

4. Given a set or object divided into parts and given a fractional name, states whether the set or object is divided into that fractional part. (states whether fractional parts)
5. Given a fractional name and given an object or set divided into an appropriate number of fractional parts, represents that fractional name. (represents fractional name)

OVERVIEW

This is the last topic in a series of six sentence writing topics in DMP. It reviews solving and validating open sentences 0-20 and writing and solving sentences for the following story situations:

joining
separating
difference
part-part-whole
equalizing

The following attributes are used:

length
numerousness
weight
capacity
distance

In the previous five sentence writing topics the children were asked to give one, two, or all three of the following symbolic responses:

a) part-part-whole chart $\begin{array}{|c|c|}\hline \multicolumn{2}{|c|}{W}\\ \hline p & p\\ \hline \end{array}$

b) horizontal sentence $a + b = \square$, $a - b = \square$

c) vertical sentence $\begin{array}{r} a\\ \underline{+b}\end{array}$, $\begin{array}{r} a\\ \underline{-b}\end{array}$

By the end of this topic the children should master the addition/subtraction facts 0-20 and be able to write and solve a sentence, $a + b = \square$ or $a - b = \square$ for a story situation involving the numbers 0-20. It is expected, also, that the children will begin to be able to analyze the story situation mentally, drawing the part-part-whole chart only when necessary, in order to write a sentence.

Also, this topic introduces the addition of three or four numbers whose sum is less than or equal to 20.

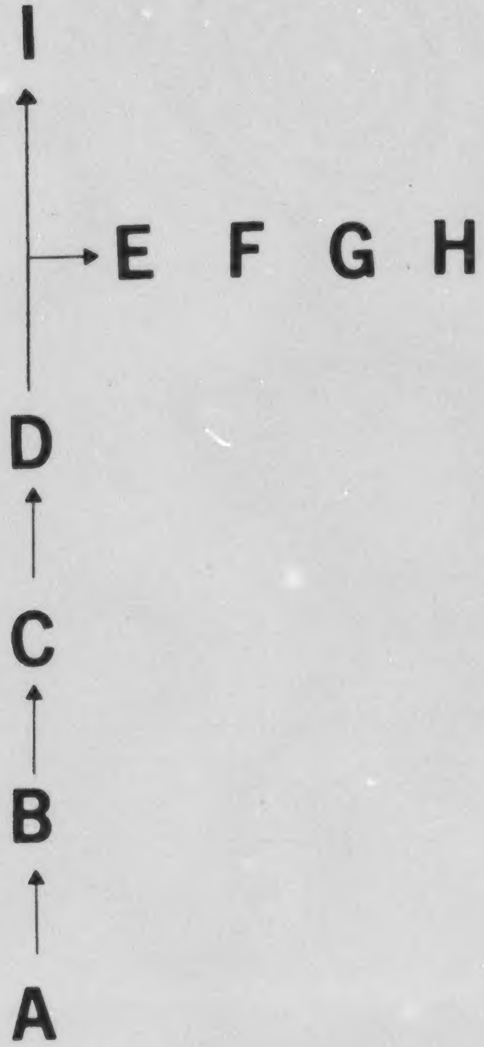
Do Activities A, B, C, D, and I.

From Activities E, F, G, and H pick only those pages and games that you think will most benefit individual children. These four activities contain more material than any child need do at this time. You may use this material as periodic or weekly review throughout the rest of the year.

The Topic Inventory may be given after activity D if you feel the children need no further practice.

Feel free to add any activities or pages of your own to practice writing and solving sentences.

SUGGESTED SEQUENCE CHART



ACTIVITY S6 A

This activity reviews writing and solving sentences 0-20.

Objectives

1 solves $a + b = \square$ sentence 0-20

2 solves $a - b = \square$ sentence 0-20

3 writes open + or - sentence 0-20

Organization

individual (Parts 1 and 2)

group (Part 2)

Materials

Student Booklet pages 2 and 3 (part 1)

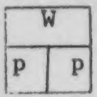
Student Booklet pages 4-6 (Part 2)

objects (Parts 1 and 2)

Preparation

No special preparation.

Teaching Suggestions

This activity reviews the story situations presented in the earlier sentence writing topics. In the previous topics the children learned to use the P-P-W chart,  to analyze situations, to represent the situation with a horizontal sentence, $a + b = \square$ or $a - b = \square$, and to represent the situation with a vertical sentence, $\begin{array}{r} a \\ \underline{+b} \end{array}$ or $\begin{array}{r} a \\ \underline{-b} \end{array}$.

The situations presented were joining, separating, part-part-whole, and difference, and the attributes used were numerousness, length, weight, capacity, and distance. All situations are reviewed and the children follow directions as to which sentence to write, horizontal, vertical or both. In all situations, the children may use the P-P-W chart to analyze. Throughout this activity encourage the children to think about the missing piece of information in each situation.

Is it a part?

Is it a whole?

Will it have to be greater than the numbers given or less than the numbers given?

Will I add or subtract to find the missing information?

After the children have represented and solved a problem, have them look at the complete sentence and at the story. Does the answer make sense? Also have them validate by using counting or objects.

Part 1. This part consists of Student Booklet pages 2 and 3.

Page 2. The children read the story problems, write the sentence representing each situation, and solve the open sentence.

Page 3. These verbal problems may also be solved by using objects after the sentence is written. Or, you may wish to pair good readers with poor readers for this page. Ask the children to validate their sentences for you; or you may have the children trade papers and validate each other's work.

Part 2. This part introduces the story theme for this topic and provides practice with more difficult situations than those in Part 1. Begin by reading the following paragraph to the children. Also give each child paper and pencil.

THE DEEP SPACE PATROL

Zipping across the galaxies in their glowing space ship are Win, Tad, Joy and their incredibly strange, walking, talking, air-breathing fish, Fudsy. They are the DEEP SPACE PATROL, sent to explore the galaxies far away from their home planet earth. And these are their adventures.

Before taking off on one of their exploring missions, they stopped at a spaceport to refuel and get more on supplies. Here are some stories about what they loaded. For each story, write a sentence with a box, then solve.

Stop.

As you read these stories try to note which types give the children the most difficulty. Then include practice with these types from the rest of the activities in this topic.

Have the children listen carefully because some of the stories are long.

1. Tad put on 6 tanks of sleeping gas. Joy put on 7 more, in case they had to put any strange space creatures to sleep. How many tanks did they load?

   $6 + 7 = \boxed{13}$ tanks

2. When the ships fuel containers are full they hold 11 tons of solid fuel. Win reported that the containers only had 4 tons in them. How many more tons of fuel should they put is so that the containers will be full?

   $11 - 4 = \boxed{7}$ tons

3. Joy wants to walk in space this trip. She got a special breathing tube that is 8 space arms long. She had one already that was 7 space arms long. What is the difference in length between the two tubes?

   $8 - 7 = \boxed{1}$ space arm

4. It takes 18 boxes of fish food to fill Fudsy's Food-o-matic. There are 9 boxes left from the last trip. How many more boxes does he have to get to fill his food-o-matic?

   $18 - 9 = \boxed{9}$ boxes

5. Win loaded 20 food packs. 9 were liquid food. The rest were solid food. How many packs were solid food?

$20 - 9 = \boxed{11}$ packs

6. There are two large storage places in the space ship. For the ship to fly right, both storage places have to have an equal amount of weight. One has 19 super space tons of weight, the other has 10 super space tons of weight. How much more weight should they put much more weight should they put in that second one so that it will equal 19 super space tons?

$19 - 10 = \boxed{9}$ super space tons

7. Fudsy loaded 5 cases of special scientific equipment. Then he loaded 3 more cases of equipment. How many cases did Fudsy put on the space ship?

$5 + 3 = \boxed{8}$ cases

8. Joy decided this trip would take 15 days. It will take 6 days to explore the planets Bog and Trix.

The rest of the days they can use to explore a lot of mysterious moons. How many days will they have to explore the moons?

$15 - 6 = \boxed{9}$ days

Next have the children do Student Booklet pages 4-6, which give situations, using the attribute of numerousness, and ask the children to write and solve sentences.

ACTIVITY S6 B

This activity gives the children practice in writing and solving sentences.

Objectives

1 solves $a + b = \square$ sentence 0-20

2 solves $a - b = \square$ sentence 0-20

3 writes open + or - sentence 0-20

Organization

large group (parts 1 and 3)

small group (parts 2 and 3)

individual (parts 1 and 2)

Materials

Student Booklet pages 7, 8,9 (part 1)

Student Booklet pages 10, 11, 12, 13 (part 2)

balances (part 2)

small washers (part 2)

objects (part 2)

cubes (part 2)

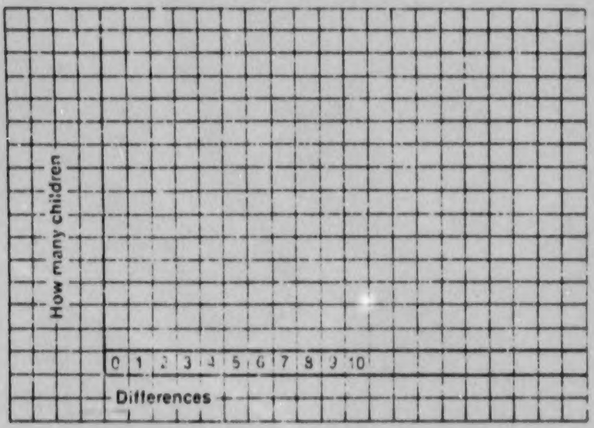
geometric pieces Ⓝ (part 2)

coins (part 3)

Preparation

Part 2. Weigh at least one set of four objects with small washers. Pick objects whose weights when joined, separated, or equalized, will involve the numbers 11-20. Use masking tape to label the members of the set U, V, W, and X. Place them at a station with small washers and a balance. Set up more than one station if you wish.

Part 3. Prepare the demonstration graph paper by labeling it like this:



Teaching Suggestions

This activity provides practice in writing and solving sentences. Have all children do part 1 and some of part 2. Part 3 is optional. For some of the pages in this activity the children write horizontal sentences. For other pages they write only the vertical notation. You may wish to do parts 1 and 2 together.

Part 1. This part gives the children practice in writing and solving sentences for money situations. Do a couple problems from page 7, then let the children finish pages 7 and 8, where they have to find the difference. Then have them do Student Booklet page 9, where the children read stories involving money and solve. You may wish to pair good readers with poor readers.

Part 2. This part provides experiences with the attributes of weight, area, length, and capacity. It may be organized in several ways:

a) Divide the class into four groups, with each group concentrating on one particular attribute and then switching at a given time with another group.

b) Have part of the children do part 1 or some pages from activities E, F, G, and H, while you work with a small group on some or all of the pages from part 2.

c) Do pages 12 and 13 together as a group and use pages 10 and 11 as practice later.

No child need do all of pages 10-13. Starred problems on those pages are more difficult and need not be done by all children. Student Booklet page 10. This page is about weight. The children weigh each of four objects at a station, record their weights, and use the weights to help them write and solve sentences. Student Booklet page 11. This page has a puzzle related to area. You need not call attention to the area aspect of it. Just refer to it as a puzzle. The figure can be covered by exactly 20 N pieces and each of its labeled parts by a smaller number of Ns. The children cover the labeled parts and then answer the questions underneath by writing and solving sentences.

Student Booklet page 12. On this page the children measure with cubes. Then they write and solve sentences to answer questions about those measurements.

Student Booklet page 13. On this page the capacities of four containers are given. The children write and solve sentences to answer questions about the capacities.

Part 3. Probability enters into this part. The children each toss a coin 30 times, tallying the number of heads and tails. They then determine the difference between these two numbers. For example, if there are 13 heads and 17 tails, the difference between the number of heads and tails is four.

Use the prepared demonstration graph paper to make a group graph using only the differences. Hopefully, the children may begin to see that the differences will be faily small since the chances of getting a head are equal to the chance of getting a tail. After the coin tossing has taken place but before you actually graph the differences, ask the children to predict what they think the graph will look like. Ask questions like:

Where do you think more differences will be: between 0 and 5 or between 5 and 10?

Do you think many people will get differences of more than 10?

What would you have to have to get a difference of zero?

After the graph has been completed, discuss it with the children if they seem to have an understanding ot it. For example, you might ask:

If we did this experiment again, would the graph look the same?

Why do you think most of the differences are small?

If the children do not answer readily, just post the graph as a summary of their findings.

Additional Suggestion

This suggestion is open-ended and consists of ways to expand upon or extend the measurement experiences in Part 2. The children may wish to measure long distances or lengths in the room and try to find sums or differences in the lengths or equalize them. Let the children make suggestions for lengths or distances to be measured, to record the problem information, and to write and solve numbers sentences ① about it. This same procedure applies to weight and capacity. Let the children, in pairs or small groups, choose objects or containers whose weights or capacities they wish to measure. Once again they do the measuring, record the necessary information, and write and solve number sentences ① about it.

If the children become especially intrigued or creative, you may wish to make a bulletin board of their work, telling what they measured and giving their results in solved number sentences. They could write descriptive sentences such as:

Tom and Pat

We measured the bulletin board.
It is 6 strips long.
It is 4 strips high.

$4 + 4 + 6 + 6 = \boxed{20}$

It is 20 strips around.

$6 - 4 = \boxed{2}$

It is 2 strips longer than it is high.

ACTIVITY S6 C

In this activity the children make up story situations that interpret given number sentences. In addition they validate solutions of sentences.

Objectives

1 solves a + b = □ sentence 0-20

2 solves a - b = □ sentence 0-20

3 writes open + or - sentence 0-20

Organization

small groups and large group (Part 1)

individuals (Part 2)

Materials

Student Booklet pages 14 and 15 (Part 2)

blank paper (Part 1)

objects for use as counters (Parts 1, 2)

Preparation

Part 1. Cut pieces of blank paper into enough strips for each small group to have three or four strips. Write one of the following sentences on each slip.

□ - 7 = 4
□ - 11 = 2
□ - 7 = 8
□ - 0 = 17
□ + 6 = 19
8 + □ = 17

□ + 13 = 16
9 + □ = 18
8 + 4 = □
15 + 0 = □
12 + 7 = □

6 + 9 = □
20 - 5 = □
13 - 2 = □
17 - 4 = □
11 - 5 = □

Teaching Suggestions

Part 1. Divide the children into small groups. Give each group a slip of paper with a sentence on it. Tell them they have until you say "Stop" to think up a story to go with the sentence and solve the sentence. Give them about five minutes to make up their story. Let each group tell or act out their story using whatever they need in the room and show their solution. Let the children be as humorous and imaginative as they wish. Have the groups validate each other's solutions. Repeat the procedure with new slips, changing the groups if necessary.

Part 2. This part consists of Student Booklet pages 14 and 15 on which the children are asked to validate given sentences or solutions. Let the children use objects to help them if they need them. The pages are self-explanatory.

ACTIVITY S6 D

More than two numbers are added to another or subtracted from another in this activity. Sometimes sentences are written, but usually the emphasis is on the solution rather than the sentences.

Objectives

1 solves $a + b = \square$ sentence 0-20

2 solves $a - b = \square$ sentence 0-20

3 writes open + or - sentence 0-20

Organization

large group (Part 1)

individual (Part 1)

pairs or small group (Parts 3, 4)

Materials

Student Booklet pages 16-20 (Part 1)

Cards 35F-a and 35F-b (Part 2)

Sum-Fun Gameboard 35F-c (3 copies) (Part 3)

duplicating master (Part 2)

connecting cubes (Part 2)

counting chips (Parts 3, 4)

piece of blank paper for each child (Part 3)

2-cm graph paper (Part 4)

crayons (Part 4)

masking tape (Part 4)

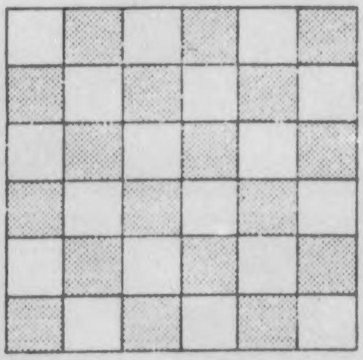
Preparation

Part 2. Prepare a master like this one and duplicate a copy for each child or pair.

Mervin	Who went the farthest? Who went the shortest distance?
Mildred	
Manfred	
Lulu	Who went the farthest? Who went the shortest distance?
Lorenzo	
Lucy	

Part 4. Select a set of six chips for each child who will be playing checkers. Each child's set must be one color. Use tape to label the chips 9, 8, 7, 6, 5, 4.

Cut, or have the children cut, from graph paper a 6 x 6-square grid for each game. Have the children color in every other square to form a 6 x 6 checkerboard.



Teaching Suggestions

Do Part 1 of this activity with all children. Choose as many of the other experiences as you wish. You may wish to have some children doing one part while others are doing another.

Part 1. This part introduces adding 3 or more numbers and subtracting the sum of several numbers from one number. Begin by looking at the cartoon at the top of Student Booklet page 16. Read the cartoon and discuss the ways the Add'em Ups do the addition. The children may use any strategy they wish to solve, including using objects. Remind the children that numbers in the vertical form should be lined up neatly. You may wish also to discuss the fact that order doesn't matter in addition.

$2 + 6 + 3 = 11$

$2 + 3 + 6 = 11$

$3 + 2 + 6 = 11$

$6 + 2 + 3 = 11$

$6 + 3 + 2 = 11$

$3 + 6 + 2 = 11$

Have the children do the rest of the problems on page 16.

Student Booklet page 17. The children find the sums, then color the trees, following the directions in the lower right corner of the page.

Student Booklet page 18. This page gives each letter of the alphabet a number value. The children use these to find the "sums" of words in sentences. You may wish the children to write their own sentences using only 3- or 4-letter words, or find the "sum" of their own names.

Next do the following problem with the children. Have the children suggest ways to solve.

I have 18 cupcakes.

I eat two.

Then I eat three more.

Then I eat 8 more.

(Then I get sick.)

How many cupcakes are left?

After trying the methods suggested by the children, point out that when they have several numbers to subtract from a given number, they can add all the numbers to be subtracted and then just subtract that sum. For example:

$$2 + 3 + 8 = 13$$

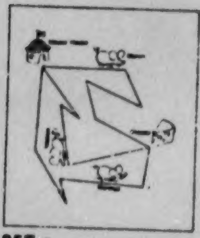
$$18 - 13 = 5 \text{ cupcakes left}$$

Then introduce Student Booklet pages 19 and 20.

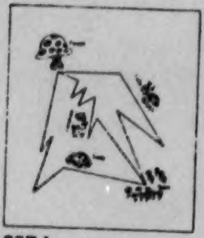
Page 19. The children read stories and solve.

Page 20. The children find the length or a piece of board when the total length and the lengths of the other pieces are given.

Part 2. The lengths of various paths are measured in this part. Since there is only one copy of Cards 35F-a and 35F-b, have some children do another part while two pairs do this part. On the cards the children measure the segments of each character's path with cubes. On the prepared sheet, they write a sentence for each character's path and determine the total length. For example: Mervin: $4 + 2 + 3 + 2 + 3 = 14$. Then the children answer the questions in the right column of the sheet.



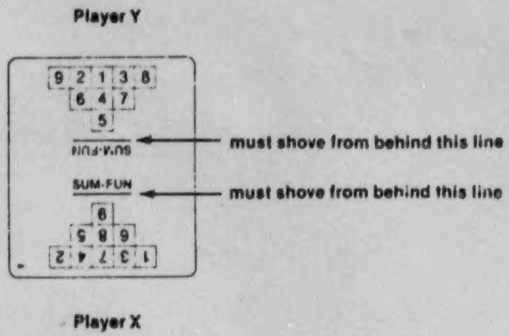
35F-a



35F-b

Part 3. A variation of shuffleboard, called "Sum-Fun," is played here with Gameboard 35F-c and counting chips. Two children play and record their scores on a blank piece of paper. The rules of the game are:

1. Each child gets three shoves in a row. The shove must be made from behind the dark line closer to the player. For example:


Player Y
9 2 1 3 8
6 4 7
5
SUM-FUN
must shove from behind this line
SUM-FUN
must shove from behind this line
Player X

2. The player counts his score after the three shoves have been made. If more than half of a chip is in a square, it counts that many points. If one chip pushes another out of a square, the one pushed out does not count. In case a chip is equally in two or more boxes the lower number is counted.

3. When each child has had a turn, the round is completed. The child with the most total points for the round is the winner.

4. The children shift ends after each round.

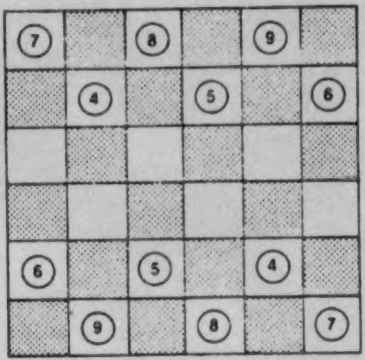
These are variations of the game:

a. Have the children keep adding up the rounds. The winner is the first one to reach 100.

b. Give a bonus point of some kind for getting a total of 20.

c. Have the children shove more than three counters each round.

Part 4. A variation of checkers is played here. It is played by two children on a 6 x 6 prepared grid. The object of the game is to jump your opponent's markers until the total of the markers jumped is at least 20. Notice that the higher numbers are in the back row. Each child sets up his markers like this:



The rules are the same as those in regular checkers except that when a marker gets all the way across the board it does not become a "king." Each player totals the markers he accumulates. The first one to get 20 or over, wins the game.

There are three variations you may want to use.

1. Have the children keep playing until someone's markers are all gone. Then they total the points.

2. Put other numbers on the markers.

3. Have the children play on an 8 x 8 board.

Additional Suggestions

Let the children make their own "Sum-Fun" boards on graph paper. There are many variations that can be tried; these are two.

1. Let each child start with 20 and subtract the points he makes. Thus, hitting small numbers becomes profitable. All the other rules stay the same.

2. Vary the arrangement of the numbers.

ACTIVITY S6 E

In this activity open sentences 0-10 are solved and validated. Number families are introduced.

Objectives

1 solves $a + b = \square$ sentence 0-20

2 solves $a - b = \square$ sentence 0-20

3 writes open + or - sentence 0-20

Organization

large group and pairs (Part 1)

individuals (Part 2)

small groups (Part 3)

Materials

Student Booklet pages 21-24 (Part 2)

connecting cubes (Parts 1, 2, 3)

blank paper (Part 1)

crayons (Part 2)

links, counting chips, or washers (Parts 2, 3)

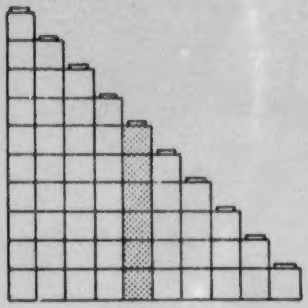
scissors for each child (Part 3)

piece of construction paper for each child (Part 3)

Preparation

Part 1. Prepare 10 rods, one for each of the numbers 1-10. Each rod should be a different color.

Part 1. Have the children gather around you. Point out the "six" rod and ask them to pretend that all the rods want to know how they can become part of the "six" family. That is, they all want to know how they can have an answer that is "six." Place the rods as shown below.



Start with the "one" rod. Ask the children how they can make the "one" rod equal to the "six" rod. Hopefully, someone will suggest adding on a "five" rod to the "one" rod. Do not actually add on to the rod but place the "six" and "one" rods side by side so the children see that five is indeed the amount needed. Then write 6 = 1 + 5, tell them that this means that 1 + 5 is another name for six, and that if you added five and one, the result would be six. On the board write:

6 Family

1 + 5

Repeat this same basic procedure with two, three, four, and five. For the "six" rod ask how it could be made equal to itself (add on or take away zero). Suggest both of those possiblities as names and record them. Notice that for the next number (seven) to be made equal to six, one must be taken away from it. Continue up through ten. The column should read:

6 Family

1 + 5

2 + 4

3 + 3

4 + 2

5 + 1

6 + 0

6 - 0

7 - 1

8 - 2

9 - 3

10 - 4

Be sure to mention that there are other names for six, such as 11 - 5, 12 - 6, etc., but you are going to stop at ten this time. Do one or two other number families, for example, three and ten, and treat them in the same manner.

Erase the family lists. Assign each pair of children a number family to find names for (be sure to include zero). Give everyone cubes (if they need them) and a piece of blank paper. The children label their paper with their number; then they write other names for that number. You may wish to post all the sheets afterwards; they should be a fairly complete list of the number names involving the number 0-10.

Part 2. Student Booklet pages in this part give the children practice in choosing correct names for a number. They are graduated in difficulty, so everyone should probably do them in order.

Pages 21 and 22. The children look at more families--of mushrooms and owls--and color the babies that have the same name as the parents.

Page 23. Have the children color each fish a different color and color the worms according to the fish they go with.

Page 24. This page is more difficult because first the children must decide what number family the given name (or phrase) belongs to and then make up another name (phrase) for that family. As the children work, ask them to show how they know a particular name is right; that is, ask them to validate their answers.

Part 3. Divide the children into 11 groups. Assign each group a different number from zero to ten to be their family number. Each child in a group gets a sheet of construction paper. S/he folds it into sixteenths and puts the group's number in one of the boxes. In a second box, the word for the number is written--that is, "zero," "one," "two," etc.

All the children in the group work together to generate 14 names for their number using the numbers 0-10. Each child records these 14 "names" in the boxes on the construction paper. Then the children cut apart the 16 boxes, making small cards. The cards from each group may then be pooled. Additional Suggestion 1 offers several ways to use the cards the children have made in this activity.

Additional Suggestions

1. Make decks of 48 cards from the construction paper cards in Part 3. These can be adapted for these variations.

a. The cards can be sorted into piles; all cards with different names for the same number should be put into a single pile.

b. This is a variation of the game "Concentration." Place 24 appropriately chosen cards (for example, four different names for six numbers) face down on the floor. A child turns over two cards. If he turns over a pair, he keeps them; otherwise the cards are turned face down again and it is the next child's turn. Two to four children may play.

c. "War" can be played with these cards. Each child uses a deck of 10 to 20 cards. When the cards are paired, the player with the card that names the larger number wins. If the same number is named, the two cards are held until the next pairing and then go to the winner of that pairing.

2. Write the numbers 0-10 on separate slips of paper. Divide the class into small groups of from three to five members each. Have each group pick one of the slips you prepared. Tell them they are to think of as many other correct names for that number as they can in the allotted time (allow five or ten minutes). The group gets a point for each correct name and loses a point for each incorrect one. Numbers above 10 are accepted as long as they are correct. Give each group objects to use to validate their answers, if necessary.

3. Pairs of children can play variations of the game dominoes if you happen to have sets of dominoes available. Instead of matching similar squares, the rules could be adjusted so that matching takes place if:

two squares to be matched have a specified number as their sum.
two squares to be matched have a specified number as their difference.
two squares to be matched have either a specified sum or difference.

ACTIVITY S6 F

This activity generates names for numbers.

Objectives

1 solves a + b = ☐ sentence 0-20

2 solves a - b = ☐ sentence 0-20

3 writes open + or - sentence 0-20

Organization

individuals (Parts 1, 2)

pairs or small groups (Part 3)

Materials

Student Booklet pages 25-27 (Part 2)

piece of construction paper for each child (Part 1)

objects for use as counters (Parts 1, 2)

scissors (Part 3)

Preparation

Part 3. Make up extra cards involving the numbers 11-20 if the children did not make enough with those numbers during Part 1.

Teaching Suggestion

The intent of this activity is similar to that of E, only there the numbers 1-10 were involved while here emphasis is placed on 11-20. Choose as many parts as you wish.

Part 1 This part involves a contest. Before you begin the contest, briefly review the idea of names for the same number, or number "families." Ask the children for some members of the 13 Family. Probably they will start suggesting them randomly. Organize their thoughts by making a list like this:

13 Family

20	13	6
19	12	5
18	11	4
17	10	3
16	9	2
15	8	1
14	7	0

Now (using objects if necessary) the children use the listed number as the first part of the name and decide what must be added on or taken away from each number so it will be a name for 13. Complete the list together.

13 Family

20 − 7	13 − 0	6 + 7
19 − 6	13 + 0	5 + 8
18 − 5	12 + 1	4 + 9
17 − 4	11 + 2	3 + 10
16 − 3	10 + 3	2 + 11
15 − 2	9 + 4	1 + 12
14 − 1	8 + 5	0 + 13
	7 + 6	

Announce the "Name Contest." Give each child counters and a piece of construction paper which he is to fold into sixteenths. Assign a number from 1-20 to each child. Tell the children you will give them five minutes to come up with as many names for their number as possible. Tell the children who have the numbers 1-10 that their names must include at least one number from 11-20 to count in the contest. They write one name in each box and get a new piece of paper if they run out. At the end of five minutes, check the names and announce the winner. Save these sheets for Part 3.

Part 2. Student Booklet pages 25 to 27 provide the children with practice in choosing names for numbers. The pages are self-explanatory. Let the children work at their own speed. Some may wish to draw other strange creatures and give them number names. Make up more pages like these if your children need more work with other names for numbers.

Part 3. This part consists of suggestions for games which can be played using cards the children made in Part 1. First have the children cut their sheets into 16 cards. The cards must then be sorted into sets according to what is to be done with them.

War: sets of 10-15 randomly selected cards

Concentration: 10-15 pairs of names

Sorting: sets of 20-40 cards randomly selected

The rules for each of the above games are found in the Additional Suggestions to Activity G. The games motivate the children to practice adding or subtracting. Feel free to make up other games that utilize these cards.

ACTIVITY S6 G

This activity uses Student Booklet pages and games to give children practice in solving open sentences and in writing sentences to describe problem situations.

Objectives

1 solves $a + b = \square$ sentence 0-20

2 solves $a - b = \square$ sentence 0-20

3 writes open + or - sentence 0-20

Organization

individuals (Part 1)

individuals or pairs (Part 2)

pairs or small groups (Parts 3, 4)

large group or individuals (Part 5)

Materials

Student Booklet pages 28-33 (Part 1)

Picture 35H (Part 5)

crayons (Part 1)

objects for use as counters (Part 1)

animal pictures from magazines (Part 2)

paste (Part 2)

construction paper (Part 2)

scissors (Parts 2, 3, 4)

piece of paper for each child (Part 3)

shoe boxes or other boxes (Part 3)

marbles (Part 3)

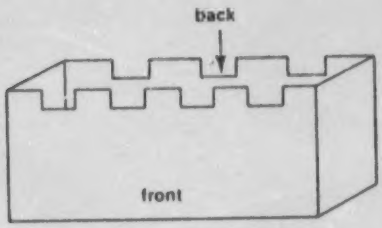
duplicating masters (Parts 4, 5)

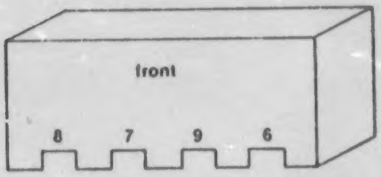
PREPARATION

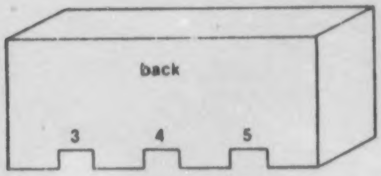
Part 1 Each child needs an orange, a black, a purple, a yellow, a red, and a green crayon.

Part 2 See Part 2 for detailed directions.

Part 3 Cut large notches in the sides of several boxes. Turn each box upside down and write in numbers above the holes.







The children make their own boxes and choose how many holes to make and how to number them.

Part 4 Make a master divided into 24 equal parts and duplicate a copy for each child.

Part 5 Make up a master with questions about the dragon and duplicate a copy for each child. See Part 5.

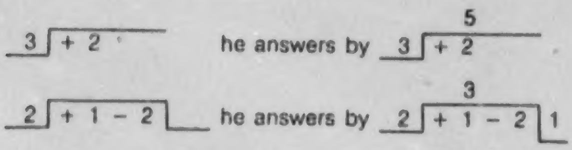
TEACHING SUGGESTIONS

Practice in solving open sentences and in writing sentences to describe situations is provided in this optional activity. It includes a variety of sheets and games. Choose whatever parts are appropriate for your children.

Part 1 Various Student Booklet pages are provided in this part.

Page 28. The children solve sentences and then color the parts of the picture with the indicated colors.

Page 29 These are stair-step problems. The child *writes the answer on the next stair*. For example:



Pages 30 and 31 The children *solve stair-step problems*.

Page 32 Number puzzles are provided on this page. Each one involves six number sentences to *solve*.

In an addition puzzle the numbers inside the puzzle are added down and across to get the totals around the outside.

+

3	2	5
4	0	4
7	2	9

In a subtraction puzzle the second numbers down and across are subtracted from the first to get the differences around the outside.

−

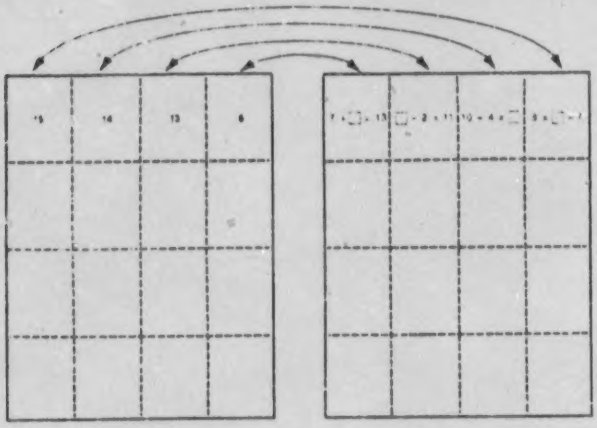
8	4	4
3	2	1
5	2	3

You may wish to make up similar puzzles or let the children generate their own and trade.

Page 33. This page has number puzzles for the children to solve and spaces for them to make up two puzzles. They can trade these with others and solve.

Use whichever pages will benefit your children and feel free to make up similar pages or to let the children do so. The children may use objects to solve if they wish, but be sure to encourage them to try to solve mentally. You can ask appropriate questions to help them make intelligent guesses. Then they can validate their solutions using objects.

Part 2 This part explains how to make picture puzzles that give the children practice in solving sentences. Cut out animals or other interesting pictures from magazines. They should be rectangular in shape and large enough to cover a piece of construction paper. Paste each rectangle on a piece of construction paper. Trim the edges. Cut another piece of construction paper the same size and fold it into sixteenths. On each sixteenth write an open sentence. Be sure the solutions are all different. Now fold the construction paper with the picture into sixteenths and turn it over. Write the solutions to the sentences on the back of the picture so they will correspond to the open sentences on the other piece of paper. Be sure to reverse the answers so the picture will turn out right.



Cut the picture on the folds and scramble the pieces. Have the children put the puzzle together by pasting the piece with the correct solution on the reverse side directly in the box with the corresponding open sentence. The children can do this puzzle in their own time. They may want to make their own puzzles and use pictures they have drawn instead of magazine pictures. There are many variations.

Part 3 This is a simple game that gives the children practice in adding and subtracting. They play in pairs or small groups. A player gets to roll four marbles (one at a time) at the prepared box. He adds up the points above the front door for each marble that goes into one of the front doors of the box; he subtracts the number above the back door if a marble goes out one of the back doors. For example, Joe rolls four marbles. One goes in a front 6 door, one goes in a front 8 door, one goes in the front 7 door, and one does not go in any door. But one of the marbles goes out a back door numbered 5. So Joe adds 6 + 8 + 7 = $\boxed{21}$ and then subtracts 21 − 5 = $\boxed{16}$. The final answer is his score. Undoubtedly, the children will be able to come up with many variations and changes.

Part 4 Give each child a prepared sheet. He numbers the sheet from 0-20 and cuts on the heavy lines. He then has a set of number cards. These are several suggestions for using these number cards.

1. A child chooses one number card (for example, 15) and pairs the rest to be additive names for it. For example:

$\boxed{15}$
$\boxed{14} + \boxed{1}$
$\boxed{13} + \boxed{2}$
$\boxed{12} + \boxed{3}$
$\boxed{11} + \boxed{4}$
$\boxed{10} + \boxed{5}$
$\boxed{9} + \boxed{6}$
$\boxed{8} + \boxed{7}$

2. A child chooses one card (for example, 8) and pairs the rest to be subtractive names for it. For example:

$\boxed{8}$
$\boxed{20} - \boxed{12}$
$\boxed{19} - \boxed{11}$
$\boxed{18} - \boxed{10}$
$\boxed{17} - \boxed{9}$
$\boxed{15} - \boxed{7}$
$\boxed{14} - \boxed{6}$
$\boxed{13} - \boxed{5}$

3. A child uses two decks of cards and makes all the possible additive or subtractive names for a number.
4. Two children make open sentences using the blank cards and take turns solving.

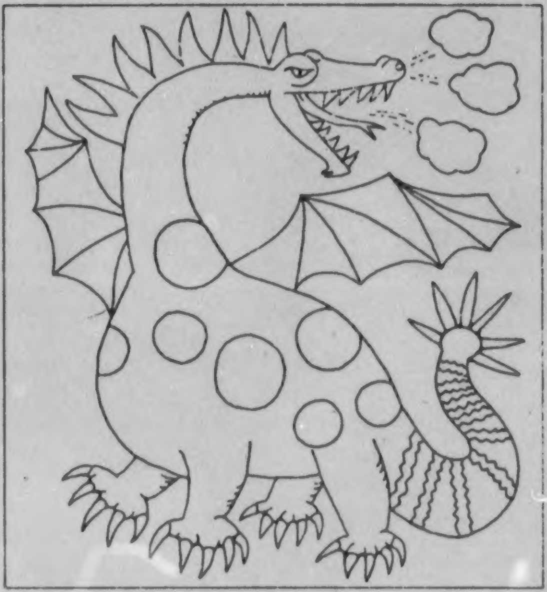
Part 5 This part is open-ended. Picture 35H is furnished and there are several ways you can use it. Every number from one to ten is represented on the dragon. It has:

one tail
two wings
three puffs of smoke
four feet
five sharp claws on each foot
six spikes on the end of its tail
seven polka dots on its body
eight pointed scales on the back of its neck
nine stripes on its tail
ten pointed teeth

You may make up a sheet asking questions about the dragon, such as:

How many polka dots would two dragons have?
If the dragon had seven more spikes, how many spikes would he have?
How many scales and spikes does the dragon have altogether?

You may ask the children to make up similar questions; they are free to use their imaginations. The questions the children make up can be traded and answered by others, or you can compile them for use in contests or extra activities for the children to do for fun. The picture might prompt the children to write stories or poems.



35H

ACTIVITY S6 H

This optional activity contains challenging problems for those children who are ready to seek out patterns and to form generalizations.

Objectives

1. solves a + b = sentence 0-20
2 solves a - b = sentence 0-20
3 writes open + or - sentence 0-20

Organization

individuals, pairs, and large group

Materials

Student Booklet pages 34-41

piece of 9-in x 12-in construction paper for each child

connecting cubes

counting sticks

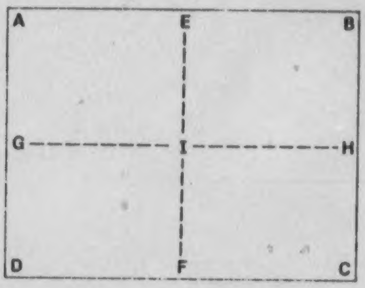
Preparation

No special preparation.

TEACHING SUGGESTIONS

This activity contains several challenging problems. Many of your children will be ready to deal with these problems now. Some will begin to see patterns and to generalize and wish to explore on their own. Others may draw only the most obvious conclusions but will at least be practicing adding and subtracting. Some children may not be able to handle these Student Booklet pages at all. Explanations follow for the pages. Use whichever ones meet your children's needs.

Pages 34 and 35 Before the children do these two pages, direct them to fold and label a piece of construction paper.



Notice that E, F, G, H, and I are on fold lines. The children must fold carefully when they fold the sheet in half each way.

After each child has carefully folded and labeled his construction paper, he is ready to measure distances on the paper using connected cubes and to answer the questions on the Student Booklet pages. The children may discover interesting results relating to the fact that opposite sides of a rectangle are equal in length and that diagonals of a rectangle are equal in length. If the children are ready to verbalize some of these results, encourage them to. Otherwise, exposure to these pages is sufficient now.

Page 36 On this page the children make triangles, squares, and rectangles using counting sticks and write sentences to answer the questions asked.

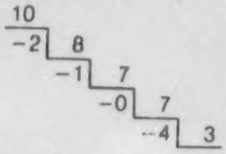
Page 37 On this page the children must first find the sum or difference of two numbers given on one side of the = sign in a sentence. When they have done this correctly, they *solve* the sentence and fill in the box.

Page 38 Let the children use objects to help solve if they wish, but encourage them to think about the sentences and look them over carefully. No child need do every problem on this page. The children may be able to reason out some of the answers using reasoning like this:

$9 + 6 \boxed{=} 6 + 9$	They must be equal because they are the same numbers added the other way around.
$9 + 8 \boxed{\neq} 9 - 8$	The 9 + 8 must be bigger because adding something to 9 makes it bigger than taking away something from 9.
$17 - 9 \boxed{\neq} 14 - 9$	The 17 − 9 must be bigger because if you take 9 away from both, the one that was bigger to start with will still be bigger.
$11 + 4 \boxed{\neq} 4 + 12$	The 4 + 12 must be bigger because if you add the same number (4) to two different numbers, the one that was bigger first stays bigger.
$19 - 16 = \square - 16$	The solution must be 19 because 19 − 16 has to equal 19 − 16.
$8 + 6 = \square + 8$	The solution must be 6 because 8 + 6 is the same as 6 + 8.

Make up more such pages if the children seem to be enjoying them.

Page 39. This page is similar to previous stair-step problems, only the problems here are more difficult. The children *write an answer on each stair*. For example:



Let the children make up their own stair-step problems too. You may wish to ask some of the children to *validate* their solutions for you.

Page 40. This page presents sentences with two unknowns. Different values are suggested for the first unknown (box) in each sentence and the children then *determine in each case the value of the second unknown (box)*. Some of the suggested values have no positive partner in the second column. Remember to tell the children that later they will learn how to answer these problems as well.

Page 41. This page involves sentences with two unknowns. The children look at what happens to the second unknown when the value of the first is systematically changed. There will be many values of the first unknown for which no positive solution exists. Have the children just leave those blank, reminding them that they do not know how to solve such problems yet. You may wish to do this page together as a group and discuss the patterns in the solutions.

ACTIVITY S6 I

This important activity continues to develop fraction ideas.

Objectives

4 states whether fractional part

5 represents fractional name

Organization

large group and pairs (Part 1)

pairs (Part 2)

large group and individuals (Part 3)

Materials

Student Booklet pages 42 and 43 (Part 3)

construction paper (Part 1)

string (part 2)

tape (Part 2)

scissors (Part 2)

connecting cubes (Part 3)

Preparation

Part 1. Cut the construction paper to make the following strips:

two 1-inch x 12 inch strips for each child

two 1-ince x 8-inch strips for each child

Part 2. Cut a length of string for each pair. The length will depend upon how you set up Part 2.

TEACHING SUGGESTIONS

The children have been introduced to fractional parts and the names for these parts in Topics 28, 31, and 34. In those topics they looked at fractional parts of areas or capacities. As in the previous activities the children find halves, thirds, etc. (or one-half, two-thirds), of a given object—in this case, of the length of a given object. This activity gives the children another opportunity to work with fractional parts and ideas concerning them before symbolizing. Do not introduce the symbols for fractions: this is done in Topic 39. Do all parts with the children.

Part 1 Give each child the four strips you prepared and have each child choose a partner. Now have each child take one of his longer strips and fold it into halves. Ask the children to show one-half and two-halves. Have each child fold the strip into fourths and identify three-fourths, one-fourth, etc. Continue with eighths.

Tell the partners to choose strips that are not the same length. Have each fold his strip into halves and have them compare their halves. Continue with fourths. Ask questions such as:

Is three-fourths of the longer strip longer than three-fourths of the shorter strip?
Is one-fourth of each strip the same length?
Is one-half of the shorter strip longer or shorter than two-fourths of the longer strip?

Now have the partners take two strips of the same length. Have one partner fold his strip into thirds and the other into fourths. Then have them compare the lengths: one-third with one-fourth, two-thirds with two-fourths, two-thirds with three-fourths.

Let the children explore with the remaining two strips. Since the partners have strips of unequal lengths, you may want to ask questions similar to the ones just asked about the unequal strips using thirds, sixths, etc. Or you may wish to have each child find another partner with a strip of the same length and ask questions about comparing sixths and eighths.

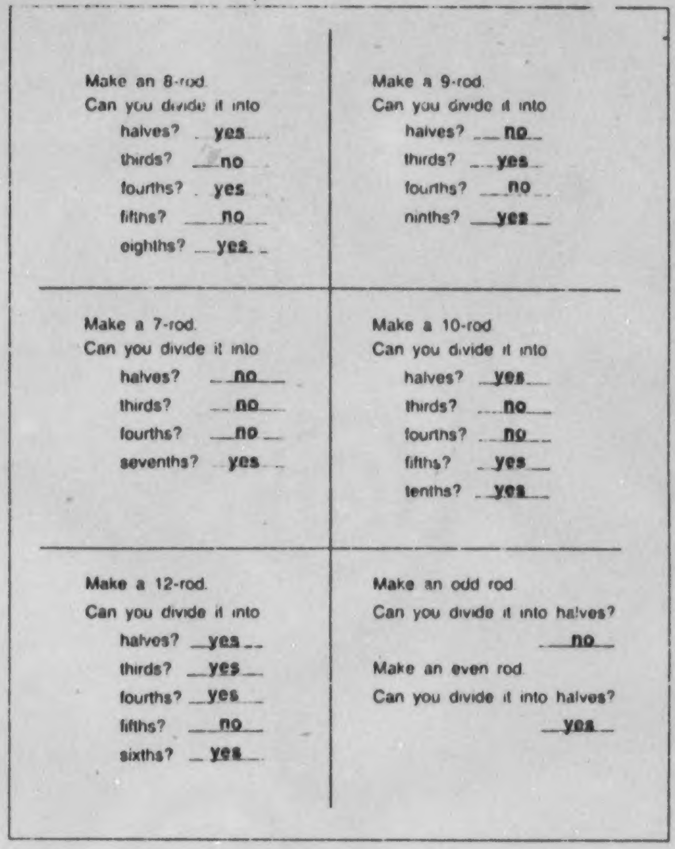
Part 2 In this part the children estimate halves, thirds, or fourths of distances and then use string to check the estimates. Demonstrate what the children are to do before letting each pair choose two spots on the floor or on a table. They should mark the spots with pieces of tape. Now have the pair guess where the halfway point between the two spots is and mark it with a piece of tape. To check their guess, they cut a string to represent the distance between the two spots, fold it to find half of it, and use this to see how close their guess was. They can guess where one-third or one-fourth of the distance would be or choose two other spots and repeat estimating halfway points.

Part 3 The children make rods with connecting cubes and try to divide them into fractional parts.

Page 42. Do the first problem together. Have the children make a rod of eight cubes (an 8-rod). Ask them if they can divide it into halves (two equal lengths), into thirds (three equal lengths), etc. Emphasize that the fractional parts must be equal in length.

The other problems on this page are similar. Either let the children proceed on their own or continue in a large group. Note in the last problem that an "odd rod" refers to a rod with an odd number of cubes.

Page 43. The children are asked to count how many cubes are in given fractional parts of a rod.



Make an 8-rod.
Can you divide it into
halves? yes
thirds? no
fourths? yes
fifths? no
eighths? yes

Make a 9-rod.
Can you divide it into
halves? no
thirds? yes
fourths? no
ninths? yes

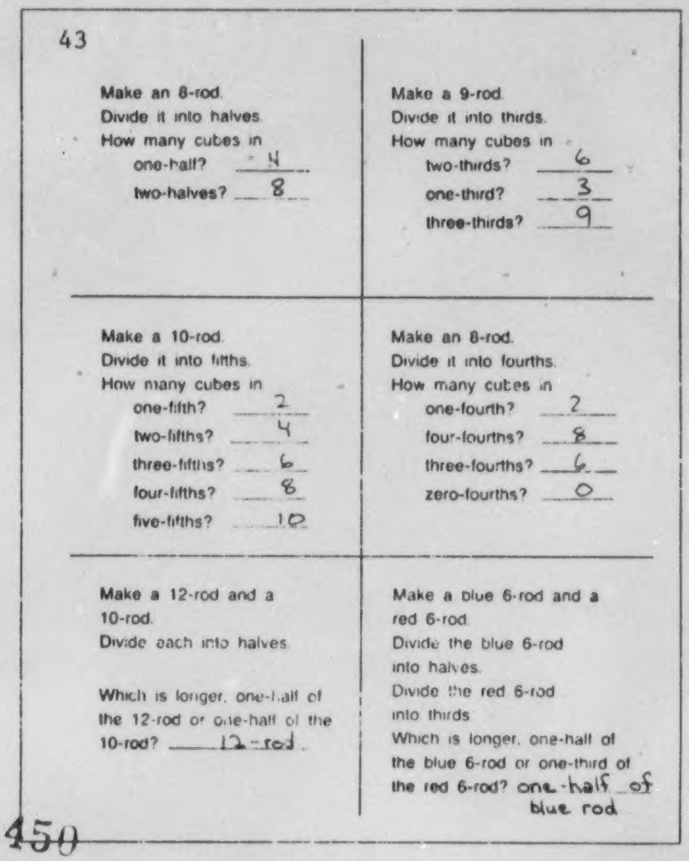
Make a 7-rod.
Can you divide it into
halves? no
thirds? no
fourths? no
sevenths? yes

Make a 10-rod.
Can you divide it into
halves? yes
thirds? no
fourths? no
fifths? yes
tenths? yes

Make a 12-rod.
Can you divide it into
halves? yes
thirds? yes
fourths? yes
fifths? no
sixths? yes

Make an odd rod.
Can you divide it into halves? no

Make an even rod.
Can you divide it into halves? yes



43

Make an 8-rod.
Divide it into halves.
How many cubes in
one-half? 4
two-halves? 8

Make a 9-rod.
Divide it into thirds.
How many cubes in
two-thirds? 6
one-third? 3
three-thirds? 9

Make a 10-rod.
Divide it into fifths.
How many cubes in
one-fifth? 2
two-fifths? 4
three-fifths? 6
four-fifths? 8
five-fifths? 10

Make an 8-rod.
Divide it into fourths.
How many cubes in
one-fourth? 2
four-fourths? 8
three-fourths? 6
zero-fourths? 0

Make a 12-rod and a 10-rod.
Divide each into halves.
Which is longer, one-half of the 12-rod or one-half of the 10-rod? 12-rod

Make a blue 6-rod and a red 6-rod.
Divide the blue 6-rod into halves.
Divide the red 6-rod into thirds.
Which is longer, one-half of the blue 6-rod or one-third of the red 6-rod? one-half of blue rod

Topic Inventory S6

You may use this group-administered inventory to:

1. confirm observations you made as the children worked Topics S4, S5, and S6;
2. assess progress if you have not been able to observe a child or if you have doubts about his/her level of mastery.

OBJECTIVES

1 solves a + b = ☐ sentence 0-20

2 solves a - b = ☐ sentence 0-20

3 writes open + or - sentence 0-20

ORGANIZATION

large group

MATERIALS

test pages and pencil for each child

clock you can see for timing page A

DIRECTIONS

On page A the children solve open sentences in horizontal and vertical form. This should be a time test. Give the children 3 minutes to do all 20 problems.

On pages B and C read each story to the children. They are to write a sentence for each story. They do not solve.

SCORING AND RATING

Score the addition and subtraction on page A separately for objectives 1 and 2. Score the ten problems on pages B and C for objective 3.

objective	ratings (number correct)		
	M	P	N
1, 2, and 3	8-10	4-7	0-3

A

Name ______________________________

Find the sum.

$$\begin{array}{ccccc} \begin{array}{r} 2 \\ +\ 3 \\ \hline \end{array} & \quad \begin{array}{r} 1 \\ +\ 8 \\ \hline \end{array} & \quad \begin{array}{r} 6 \\ +\ 8 \\ \hline \end{array} & \quad \begin{array}{r} 7 \\ +\ 0 \\ \hline \end{array} & \quad \begin{array}{r} 8 \\ +\ 9 \\ \hline \end{array} \end{array}$$

8 + 7 = ☐ 9 + 3 = ☐

3 + 6 = ☐ 7 + 7 = ☐ 4 + 9 = ☐

Find the difference.

$$\begin{array}{ccccc} \begin{array}{r} 17 \\ -\ 9 \\ \hline \end{array} & \quad \begin{array}{r} 12 \\ -\ 5 \\ \hline \end{array} & \quad \begin{array}{r} 11 \\ -\ 4 \\ \hline \end{array} & \quad \begin{array}{r} 15 \\ -\ 6 \\ \hline \end{array} & \quad \begin{array}{r} 9 \\ -\ 7 \\ \hline \end{array} \end{array}$$

10 - 7 = ☐ 11 - 5 = ☐

15 - 14 = ☐ 16 - 7 = ☐ 13 - 5 = ☐

TOPIC INVENTORY St

B

Name ______________________________

Write a sentence for each story. You do not have to solve.

1. There are 17 rats.
   9 are white.
   The rest are black.
   How many rats are black? ______________________________

2. Larry's baseball team had 9 runs.
   Jane's team had 14 runs.
   How many more runs did Jane's team have than Larry's team? ______________________________

3. There were some cars.
   6 were blue.
   7 were green.
   How many cars were there altogether? ______________________________

4. Fred made 8 snowballs.
   Then he made some more.
   He made 15 snowballs altogether.
   When he made more, how many did he make? ______________________________

5. There were 14 apples on a tree.
   Karen picked 8 of those apples.
   How many apples are left on the tree? ______________________________

6. Some jacks were in a bag.
   Alan took out 4 jacks.
   There are 10 jacks left in the bag.
   How many jacks were in the bag to start with? ______________________________

TOPIC INVENTORY 5C

Name ______________________________

C

7. Joe's stick is 17 links long.
Helen's stick is 8 links long.
How many links shorter is Helen's stick than Joe's stick? ______________________________

8. 5 girls were jumping rope.
Then 6 more girls started jumping rope.
How many girls are jumping rope now? ______________________________

9. There were 12 eggs in a box.
Some eggs fell out.
Now there are 7 eggs in the box.
How many eggs fell out? ______________________________

10. Leo's pet weighed 20 pounds.
Then it lost 6 pounds.
How much does Leo's pet weigh now? ______________________________

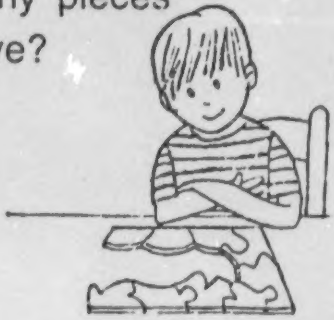
TOPIC INVENTORY 56

Write a sentence with a □ for each picture.
Then solve it.

2

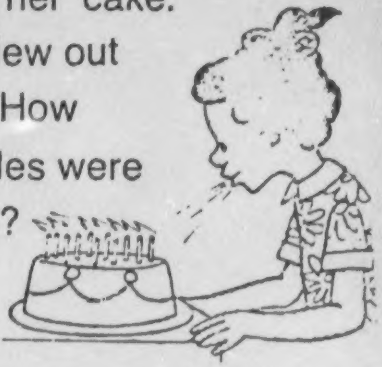
1. Tad had 9 pieces.
He found 5 more pieces.
Now how many pieces
does Tad have?

$9+5=\boxed{14}$



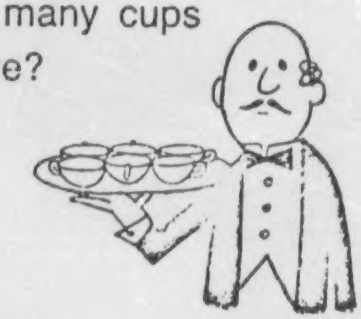
2. My sister had 11 candles
burning on her cake.
She only blew out
7 candles. How
many candles were
still burning?

$11-7=\boxed{4}$



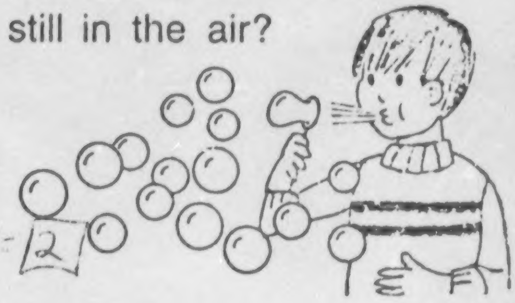
3. Elmer held 6 cups.
He put on 4 more cups.
Then how many cups
did he have?

$6+4=\boxed{10}$



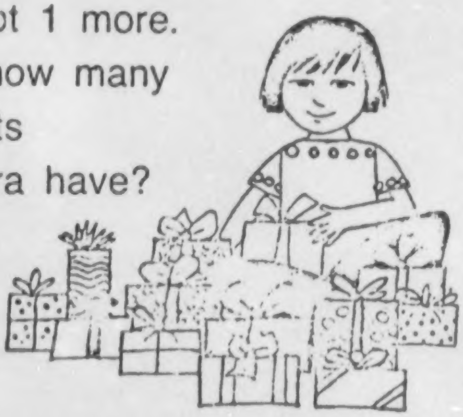
4. Jacob blew 16 bubbles.
But 14 bubbles popped.
How many of his bubbles
are still in the air?

$16-14=\boxed{2}$

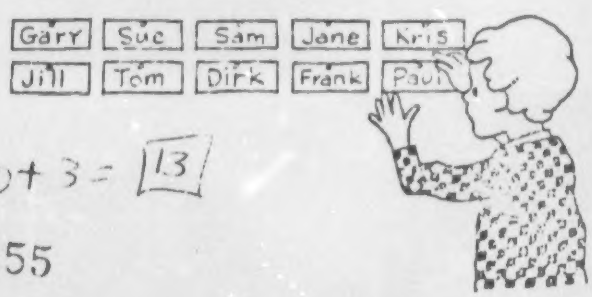


5. Tara had 13 presents.
She got 1 more.
Then how many
presents
did Tara have?

$13+1=\boxed{14}$!



6. Alan put up 10 names,
then he put up 3 more.
Now how many names
are on the wall?



$10+3=\boxed{13}$

444 Write a sentence with a □.
Then solve it.

3

1. Herbert the hippo took 6 mud baths one week and 12 mud baths the next week. How many mud baths did he take altogether?

$6+12=\boxed{18}$

2. Albert the anteater caught 16 ants. Just as he was going to eat them, 16 of them ran away. How many ants were left for Albert to eat?

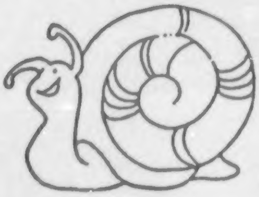
$16-16=\boxed{0}$

3. There were 18 bushes growing in a field. A flying saucer landed and crushed 4 of them. How many were still all right?

$18-4=\boxed{14}$

4. Mortimer Mouse stole 14 pieces of cheese from the kitchen. He ate 6 of them for lunch. How many pieces does he have left for supper?

$14-6=\boxed{8}$



5. Slowpoke the snail went 8 inches one week and 4 inches the next week. How many inches did he move altogether?

$8+4=\boxed{12}$

STAR COUNTING

For each story write a sentence with a box.
Then solve.

1. Joy counted 7 stars to the right and 8 stars to the left. How many stars altogether?

7+8= $\boxed{15}$

2. Fudsy counted 15 stars. Then 6 disappeared. How many were left?

15-6= $\boxed{9}$

3. Tad counted 12 stars. Some of them are yellow. The rest, 4, are blue. How many are yellow?

12-4= $\boxed{8}$

4. Win saw 8 stars. Fudsy saw 13 stars. How many more stars did Fudsy see than Win?

13-8= $\boxed{5}$

5. Win counted 5 stars. Tad counted 9 stars. How many more stars does Win have to see so that she will count as many as Tad?

9-5= $\boxed{4}$

6. Fudsy counted 10 stars above. Then he counted some more below. He counted 13 altogether. How many did he count below?

13-10= $\boxed{3}$

7. Win counted some stars. 8 of them were white. 6 of them were blue. How many strs did she count?

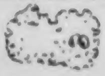
8+6= $\boxed{14}$

8. Tad counted 14 stars. Joy counted 7 stars. What is the difference?

14-7= $\boxed{7}$

STRANGE THINGS THE SPACE PATROL SAW

For each write a sentence and solve.

1 Tad saw 14  . 14 + 6 = $\boxed{20}$

Then he saw 6 more. How many did he see altogether?

2 Win counted 15 . 15 - 7 = $\boxed{8}$

7 went away.

How many were left?

3 Joy counted some . 4 + 6 = $\boxed{10}$

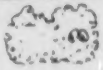
4 went away and 6 were left.

How many were there to start with?

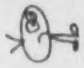
4 Fudsy saw 12

Some went away. 3 were left. 12 - 3 = $\boxed{9}$

How many went away?

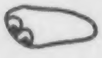
5 Win counted 11 

Some more came. There were 13 altogether. How many came? 13 - 11 = $\boxed{2}$

6 Tad saw some 

1 more came. Then there were 9. 9 - 1 = $\boxed{8}$

How many were there to start with?

7 Fudsy saw 17 

9 were green and the rest were blue. 17 - 9 = $\boxed{8}$

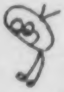
How many were blue?

8 Joy counted 10 on Monday.

She counted 18 on Tuesday. How many more were there on Tuesday than on Monday? 18 - 10 = $\boxed{8}$

MORE STRANGE THINGS

Write a sentence and solve.

1 Fudsy saw some things.
5 were and 9 were  .
How many did he see altogether?
$5+9=\boxed{14}$

2 Joy saw 7 things.
Win saw 8 things.
How many more things did
Win see than Joy?
$8-7=\boxed{1}$

3 Tad counted 10
3 went away.
How many were left?
$10-3=\boxed{7}$

4 Win counted 9
4 more come.
How many are there now?
$9+4=\boxed{13}$

5 Fudsy saw 16
Some went away.
8 were left. How many went away?
$16-8=\boxed{8}$

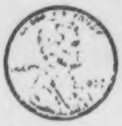
6 Joy saw some.
6 went away and 6 were left.
How many were there to start with?
$6+6=\boxed{12}$

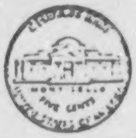
7 Win saw 12
Some more came. Then there were 14.
How many came?
$14-12=\boxed{2}$

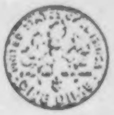
8 Tad saw 7
7 flew away.
How many were left?
$7-7=\boxed{0}$

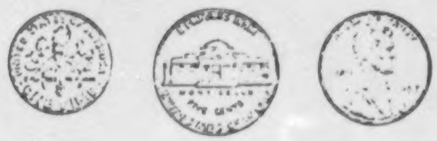
Find the difference between the coins shown and the amount in the box. Use vertical notation.

REMEMBER:


1¢

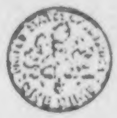

5¢


10¢



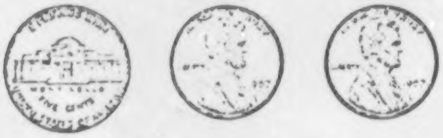
15¢

16
−15
1¢



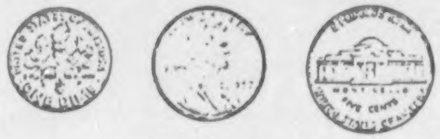
15¢

15
−10
5¢



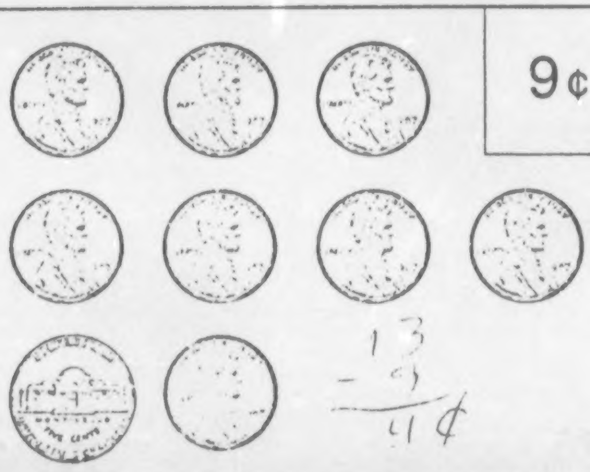
20¢

20
−7
13¢



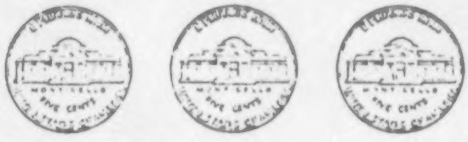
11¢

16
−11
5 ¢



9¢

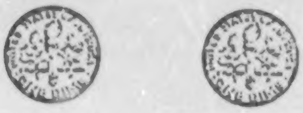
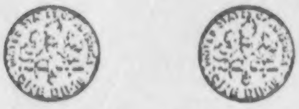
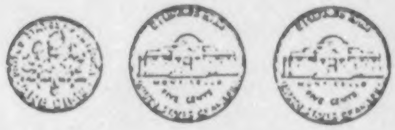
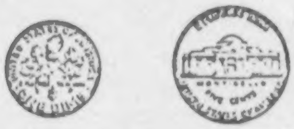
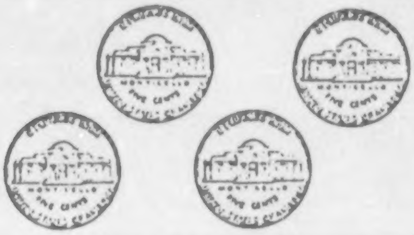
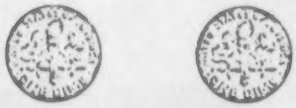
13
−9
4¢



19¢

19
−15
4¢

Find the difference between the coins shown and the amount in the box. Use vertical notation

	13¢	20 - 13 7 ¢
	15¢	20 - 15 5 ¢
	19¢	20 - 19 1 ¢
	12¢	15 - 12 3 ¢
	20¢	20 - 20 0 ¢
	16¢	20 - 16 4 ¢

Answer the questions. Use vertical notation.

1 Joy bought a light for 19¢. She paid 20¢. What is her change?

$$\begin{array}{r} 20 \\ -19 \\ \hline 1\text{¢} \end{array}$$

2 Tad bought a light for 7¢ and a ball for 3¢. How much should he pay?

$$\begin{array}{r} 7 \\ +3 \\ \hline 10\text{¢} \end{array}$$

3 Win wants a 16¢ belt. She has 9¢. How much more does she need it buy the belt?

$$\begin{array}{r} 16 \\ -9 \\ \hline 7\text{¢} \end{array}$$

4 Fudsy has 4¢ in his pocket. He has some money in his boot. He has 12¢ altogether. How much does he have in his boot?

$$\begin{array}{r} 12 \\ -4 \\ \hline 8\text{¢} \end{array}$$

5 Tad spent 8¢. If he had 11¢ to start with how much does he have left?

$$\begin{array}{r} 11 \\ -8 \\ \hline 3\text{¢} \end{array}$$

6 Joy spent 12¢ and then 7¢. How much did she spend altogether?

$$\begin{array}{r} 12 \\ +7 \\ \hline 19\text{¢} \end{array}$$

7 Fudsy has 20¢. 15¢ of it is in nickels. The rest is pennies. How many pennies does he have?

$$\begin{array}{r} 20 \\ -15 \\ \hline 5\text{¢} \end{array}$$

8 Win had 7¢. The she found a penny. How much does she have now?

$$\begin{array}{r} 7 \\ +1 \\ \hline 8\text{¢} \end{array}$$

9 Fudsy has 14¢ and Joy has 5¢. How much more does Fudsy have than Joy?

$$\begin{array}{r} 14 \\ -5 \\ \hline 9\text{¢} \end{array}$$

10 Win has 2¢ and Tad has 8¢. What is the difference in the amount of money Tad has and the amount of money Win has?

$$\begin{array}{r} 8 \\ -2 \\ \hline 6\text{¢} \end{array}$$

(Answers vary)

WEIGHT

Find out how many washers each thing weighs.

U = ____ small washers

W = ____ small washers

V = ____ small washers

X = ____ small washers

Write a sentence with a box. Then solve.

---

1. Which is lighter, W or V? ____
   How much lighter? ________________
2. Which is heavier, X or V? ____
   How much heavier? ________________
3. Find U + V. ________________
4. Find W + X. ________________

✪5. Find the difference between U +V and W + X. ________________

6. Find the difference between W and X. ________________
7. How heavy are U and X together? ________________
8. How heavy are W and V together? ________________

✪9. What is the difference between U + X and W + V? ________________

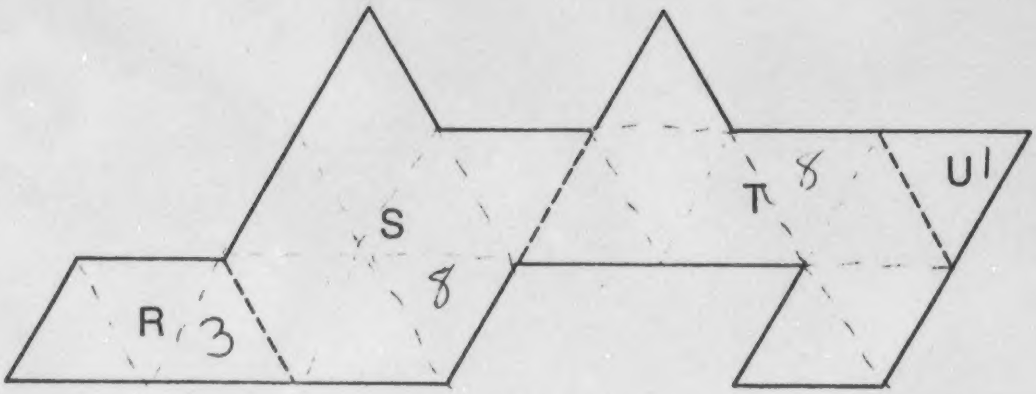
10. Find W + U ________________
11. Find X + V ________________

✪12. Find the difference between W + U and X + V. ________________

13. Find U + X. ________________
14. Find U + X + W. ________________
15. Find the difference between U and X. ________________

AREA

Find out how many of these △Ⓝ will fit in each part of the puzzle. Write that number in each part.



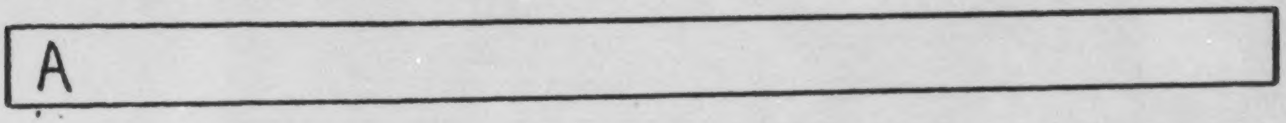
Write a sentence with a ☐
Then solve it.

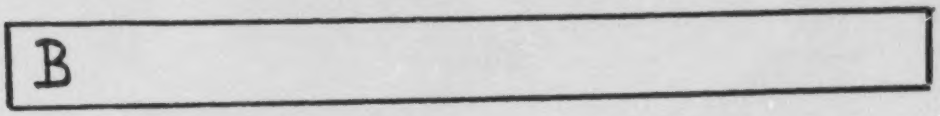
1. Add R to S. 3 + 8 = $\boxed{11}$
2. Add t and U. 8 + 1 = $\boxed{9}$
✪3. Find the difference between R + S and T + U. 11 - 9 = $\boxed{2}$
4. How many more N 's would you have to add to T to make it equal to S? 8 - 8 = $\boxed{0}$
5. Find S + T. 8 + 8 = $\boxed{16}$
6. Find S - T. 8 - 8 = $\boxed{0}$
7. Find S - R. 8 - 3 = $\boxed{5}$
8. Find S + R. 8 + 3 = $\boxed{11}$
9. Find R + S. 3 + 8 = $\boxed{11}$
✪10. Find the difference between S - R and S + R. 11 - 5 = $\boxed{6}$
11. Find T - U. - 8 - 1 = $\boxed{7}$
12. Find S + U. 8 + 1 = $\boxed{9}$
13. Find R + T. 3 + 8 = $\boxed{11}$

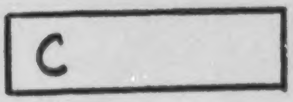
LENGTH

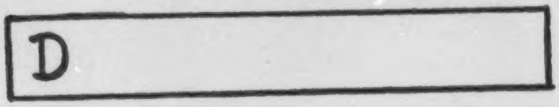
12

Use cubes to find the length of each of the strips.
Write the length on each strip.







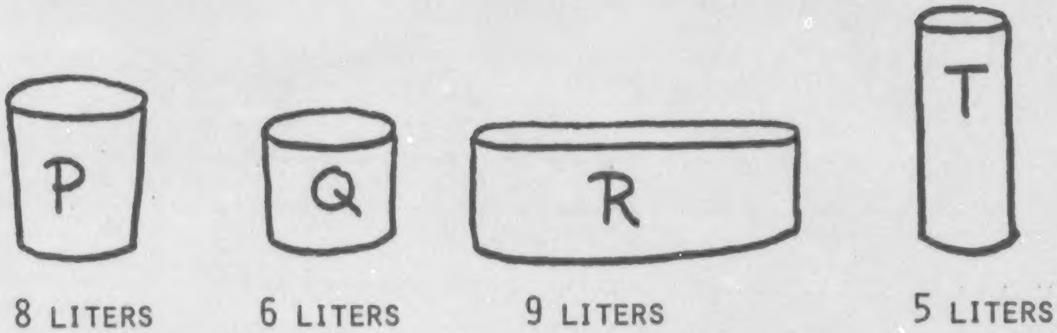


answers vary

Write a sentence with a box. Then solve.

1. How much longer is A than C? ____
2. How much longer is B than D? ____
3. Find A - B. ____
4. Find D - C. ____
✪5. Find the difference between A - B and D - C. ____
6. Find A + B. ____
7. Find D + C. ____
✪8. Find the difference between A + B and D + C. ____
9. How much shorter is B than A? ____
10. How much shorter is C than B? ____
11. If 6 cubes of A's length were colored green and the rest was colored blue, how much of A is blue? ____
12. If A were taped to C, how long would they be together? ____
13. How long are A and D together? ____
14. Find B + D. ____
✪15. Find B + D + C. ____

FUDSY'S FUEL



USE THE CONTAINERS ABOVE. WRITE A SENTENCE WITH A BOX. THEN SOLVE.

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1. Find P + Q. $8+6=\boxed{14}$
2. Find P + R. $8+9=\boxed{17}$
3. Find P + T. $8+5=\boxed{13}$
4. Find Q + R. $6+9=\boxed{15}$
5. Find Q + T. $6+5=\boxed{11}$
6. Find R + T. $9+5=\boxed{14}$

✪7. Find the difference between P + Q and R + T. $14-14=\boxed{0}$

✪8. Find the difference between P + T and Q + R. $15-13=\boxed{2}$

✪9. Find the difference between Q + T and P + R. $17-11=\boxed{6}$

10. How much more does R hold than P? $9-8=\boxed{1}$
11. How much more does P hold than T? $8-5=\boxed{3}$
12. How much more does R hold than T? $9-5=\boxed{4}$
13. How much more does R hold than Q? $9-6=\boxed{3}$
14. R is filled with gas and water. 4 liters is gas.
    How much is water? $9-4=\boxed{5}$
15. P is filled with LOX and HYD. 1 liter is LOX.
    How much is HYD? $8-1=\boxed{7}$

Circle true or false for each sentence.

14

6 − 11 = 5 true [✓ false]

1 + 20 = 19 [✓ true] false

17 − 6 = 9 true [✓ false]

4 + 14 = 18 [✓ true] false

13 − 8 = 5 [✓ true] false

14 + 1 = 13 true [✓ false]

20 − 9 = 29 true [✓ false]

8 + 8 = 17 true [✓ false]

14 − 3 = 11 [✓ true] false

3 + 9 = 12 [✓ true] false

15 − 2 = 8 true [✓ false]

2 + 13 = 5 [✓ true] false

16 − 9 = 17 true [✓ false]

6 + 5 = 11 [✓ true] false

18 − 17 = 11 true [✓ false]

0 + 20 = 20 [✓ true] false

Cross out the wrong solutions and fix them.

15

456

$\overset{8}{\boxed{\cancel{7}}} + 7 = 15$

$19 - \boxed{6} = 13$

$6 + 6 = \overset{12}{\boxed{\cancel{6}}}$

$20 - \overset{6}{\boxed{\cancel{4}}} = 14$

$18 - 6 = \overset{12}{\boxed{\cancel{2}}}$

$9 + 4 = \overset{13}{\boxed{\cancel{5}}}$

$\boxed{8} + 9 = 17$ ok

$19 - 12 = \boxed{7}$ ok

$\boxed{13} + 3 = 16$ ok

$12 - 1 = \overset{11}{\boxed{\cancel{13}}}$

$19 - \overset{19}{\boxed{\cancel{0}}} = 0$

$16 - \overset{8}{\boxed{\cancel{9}}} = 8$

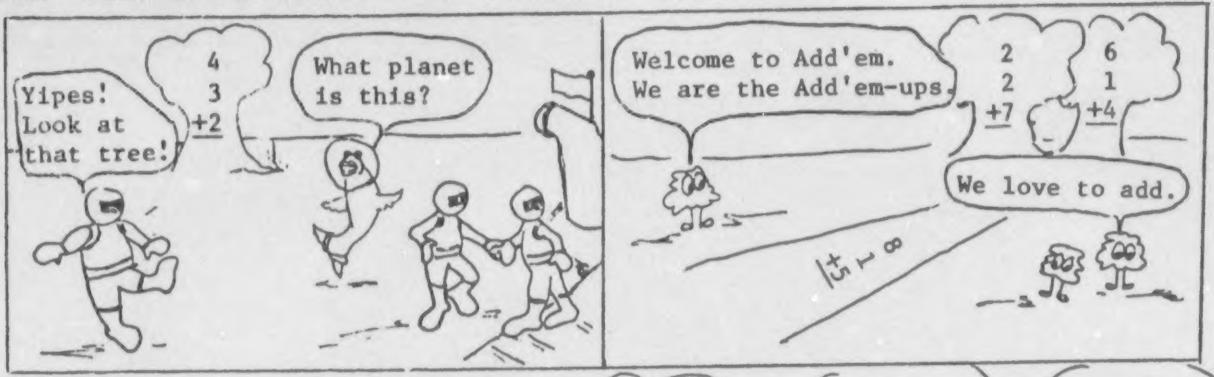
$14 + 3 = \overset{17}{\boxed{\cancel{11}}}$

$20 - \boxed{10} = 10$ ok

$\boxed{19} - 17 = 2$ ok

$14 + 6 = \overset{20}{\boxed{\cancel{8}}}$

THE DEEP SPACE PATROL MEETS THE ADD'EM-UPS.


Yipes! Look at that tree!
4 3 +2
What planet is this?
Welcome to Add'em. We are the Add'em-ups.
2 2 +7
6 1 +4
We love to add.
8 1 +5

I always add from the top down. 4+3 is 7 and 7+2 is 9.

YOU DO THESE

4	3	6	7
3	3	1	2
+ 2	+ 4	+ 2	+ 5
9	10	9	14

I always add up from the bottom. 7+2 is 9 9+4 is 13.

YOU DO THESE

4	4	1	4
2	0	3	5
+ 7	+ 2	+ 9	+ 4
13	6	13	13

I always add the two smallest numbers first. 2 + 3 is 5. 5 + 6 is 11.

YOU DO THESE

2	3	9	2
6	5	4	8
+ 3	+ 1	+ 3	+ 2
11	9	16	12

I always look for tens. 3 + 7 is 10. 10 and 4 is 14.

YOU DO THESE

3	6	2	5
4	4	6	5
+ 7	+ 2	+ 8	+ 5
14	12	16	15

Add these any way you like.

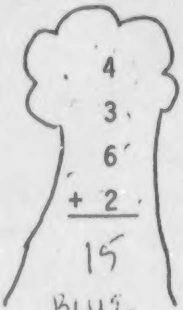
1	8	9	4	7	5	3	4	7
4	3	2	4	3	2	3	5	1
+ 1	+ 3	+ 1	+ 4	+ 8	+ 8	+ 3	+ 6	+ 7
6	14	12	12	18	15	9	15	15

THE ADD'EM UP FOREST

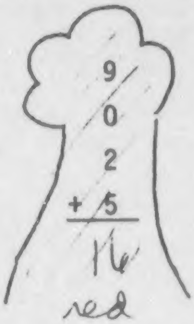
Solve these. Then color the trees as directed.

1
5
3
+ 7
16

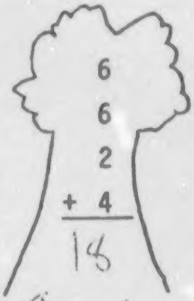
red


4
3
6
+ 2
15

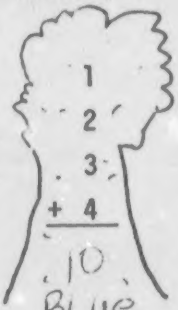
BLUE


9
0
2
+ 5
16

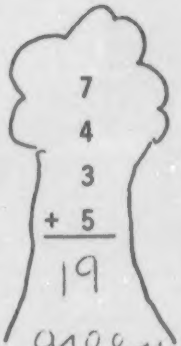
red


6
6
2
+ 4
18

green


1
2
3
+ 4
10

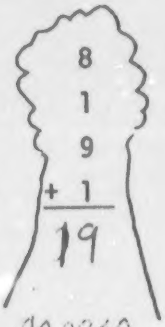
BLUE


7
4
3
+ 5
19

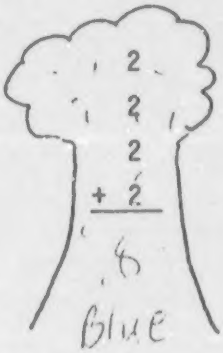
green

5
7
5
+ 1
18

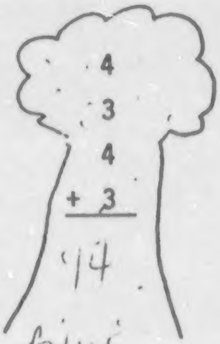
green


8
1
9
+ 1
19

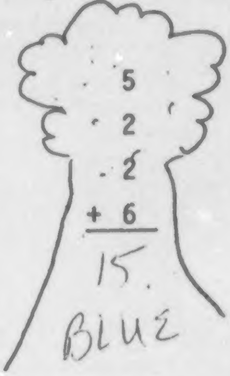
green


2
2
2
+ 2
8

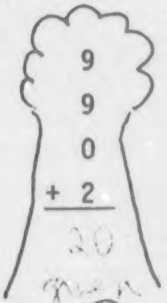
BLUE


4
3
4
+ 3
14

BLUE


5
2
2
+ 6
15

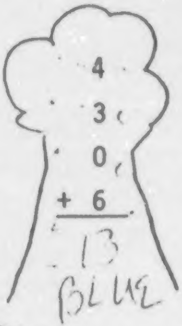
BLUE


9
9
0
+ 2
20

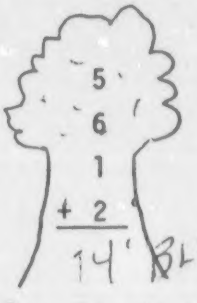
green

2
8
2
+ 8
20

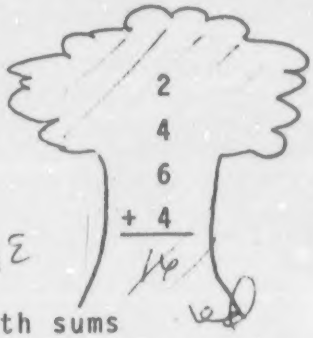
green


4
3
0
+ 6
13

BLUE

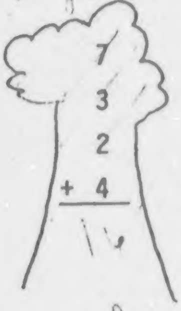

5
6
1
+ 2
14

BLUE

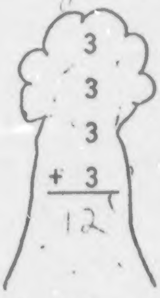

2
4
6
+ 4
16

red

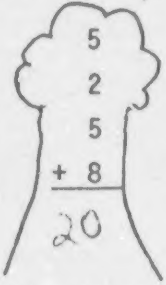
Color trees with sums
equal to 16 -- RED
less than 16 -- BLUE
greater than 16 -- GREEN


7
3
2
+ 4
16

red


3
3
3
+ 3
12

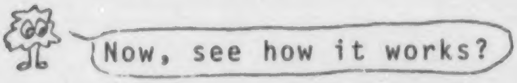
BLUE


5
2
5
+ 8
20

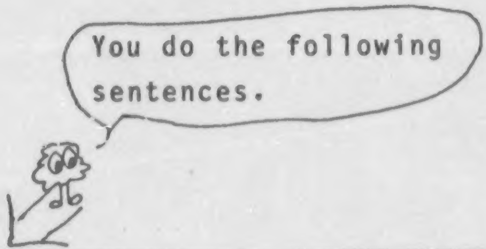
green

The Add'em-ups like to add so much that they add up words. Here is there adding alphabet.

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
3	2	1	0	4	5	6	7	8	9	0	1	2	3	4	5	6	7	6	5	4	3	2	1	0	9


Now, see how it works?

				w 2
N 3	s 6	h 7		o 4
o 4	e 4	0 4	i 8	r 7
+ w 2	+e 4	+w 2	+t 5	+k 0
9	14	13	13	s 5
				18


You do the following sentences.

The dog and the cat ate ham.

T 5	d 0	a 3	t 5	c 1	a 3	h 7
h 7	o 4	n 3	h 7	a 3	t 5	a 3
e+4	g+6	d+0	e+4	t+5	e+4	m+2
16	10	6	16	9	12	12

One pig and two rats saw Tad.

o 4	P 5	a 3	t 5	r 7	S 6	T 5
n 3	i 8	n 3	w 2	a 3	a 3	a 3
+ e 4	g 6	d 0	+ o 4	t 5	+ w 2	+ d 0
				s 6		
11	19	6	11	21	11	8

Joy fed six apes at the zoo.

J 9	f 5	S 6	a 3	a 3	t 5	z 9
o 4	e 4	i 8	p 5	t 5	h 7	o 4
y 0	d 0	x 1	e 4		e 4	o 4
			s 6			
13	9	15	18	8	16	17

Win ran into Fudsy.

w 2	r 7	i 8	F 5
i 8	a 3	n 3	u 4
N 3	n 3	T 5	D 0
		o 4	s 6
			y 0
13	13	20	15

Read each story and answer the questions.

1. There were 19 Add'em-ups.
3 went home.
8 went to the forest.
7 went to the zoo.
How many were left?

$$\begin{array}{r} 3 \\ 8 \\ +\ 7 \\ \hline 18 \end{array} \qquad \begin{array}{r} 19 \\ -18 \\ \hline \end{array}$$

(1 left

2. There were 20 food sticks.
Fudsy ate 0.
Win ate 5.
Tad ate 6 and Joy ate 4.
How many were left?

$$\begin{array}{r} 0 \\ 5 \\ 6 \\ +\ 4 \\ \hline 15 \end{array} \qquad \begin{array}{r} 20 \\ -15 \\ \hline \end{array}$$

(5 left

3. There were 18 cups of milk.
Joy drank 6.
Win drank 3 and Tad drank 2.
Fudsy drank 4.
How many were left?

$$\begin{array}{r} 6 \\ 3 \\ 2 \\ +\ 4 \\ \hline 15 \end{array} \qquad \begin{array}{r} 18 \\ -15 \\ \hline \end{array}$$

(3 left

4. There were 16 trees.
9 were red.
2 were blue.
5 were green and the rest were yellow. How many yellow trees were there?

$$\begin{array}{r} 9 \\ 2 \\ 5 \\ \hline 16 \end{array} \qquad \begin{array}{r} 16 \\ -16 \\ \hline 0 \end{array}$$

none were yellow

5. 20 words were said.
Tad said 1.
Win said 1.
Joy said 2 and Fudsy said the rest. How many did Fudsy say?

$$\begin{array}{r} 1 \\ 1 \\ +\ 2 \\ \hline 4 \end{array} \qquad \begin{array}{r} 20 \\ -4 \\ \hline \end{array}$$

(16 Fudsy said)

6. There were 12 people.
2 went to work.
4 went to play.
5 went to the store.
How many are left?

$$\begin{array}{r} 2 \\ 4 \\ 5 \\ \hline 11 \end{array} \qquad \begin{array}{r} 12 \\ -11 \\ \hline \end{array}$$

(1 left)

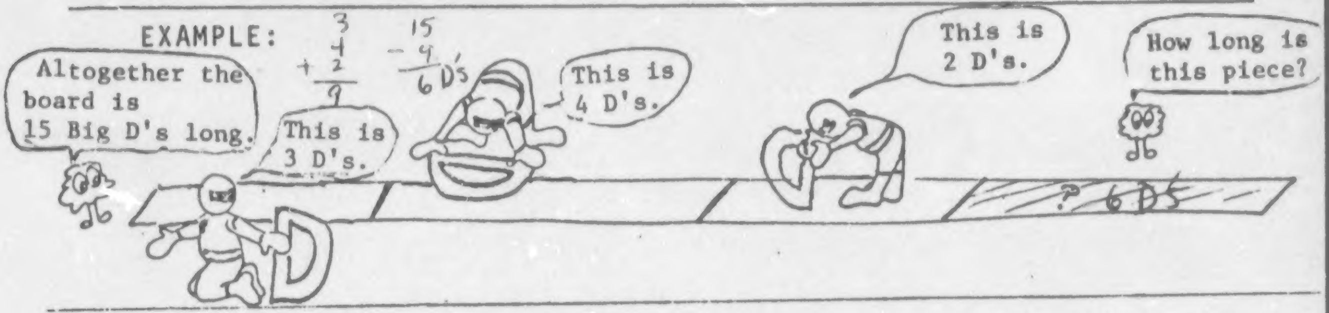
D MEASURE

The Add'em-ups measure in Big D's.
For each of the following, add and subtract to find the length of each missing piece.

EXAMPLE:

3
4
+ 2
9

15
− 9
6 D's


Altogether the board is 15 Big D's long.
This is 3 D's.
This is 4 D's.
This is 2 D's.
How long is this piece?
? 6 D's
D

1. 17 D's altogether.

6 D's	3 D's	5 D's	? 3 D's

6
3
+ 5
14

17
− 14
3 D's

2. 8 D's altogether.

2 D's	1 D	3 D's	? 2 D's

2
1
+ 3
6

8
− 6
2 D's

3. 20 D's altogether.

1 D	5 D's	7 D's	2 D's	? 5 D's

1
5
7
+ 2
15

20
− 15
5 D's

4. 14 D's altogether.

4 D's	6 D's	4 D's	? 0 D's

4
6
+ 4
14

5 10 D's altogether.

7 D's	1 D	? 2 D's

7
+ 1
8

10
− 8
2 D's

6. 19 D's altogether.

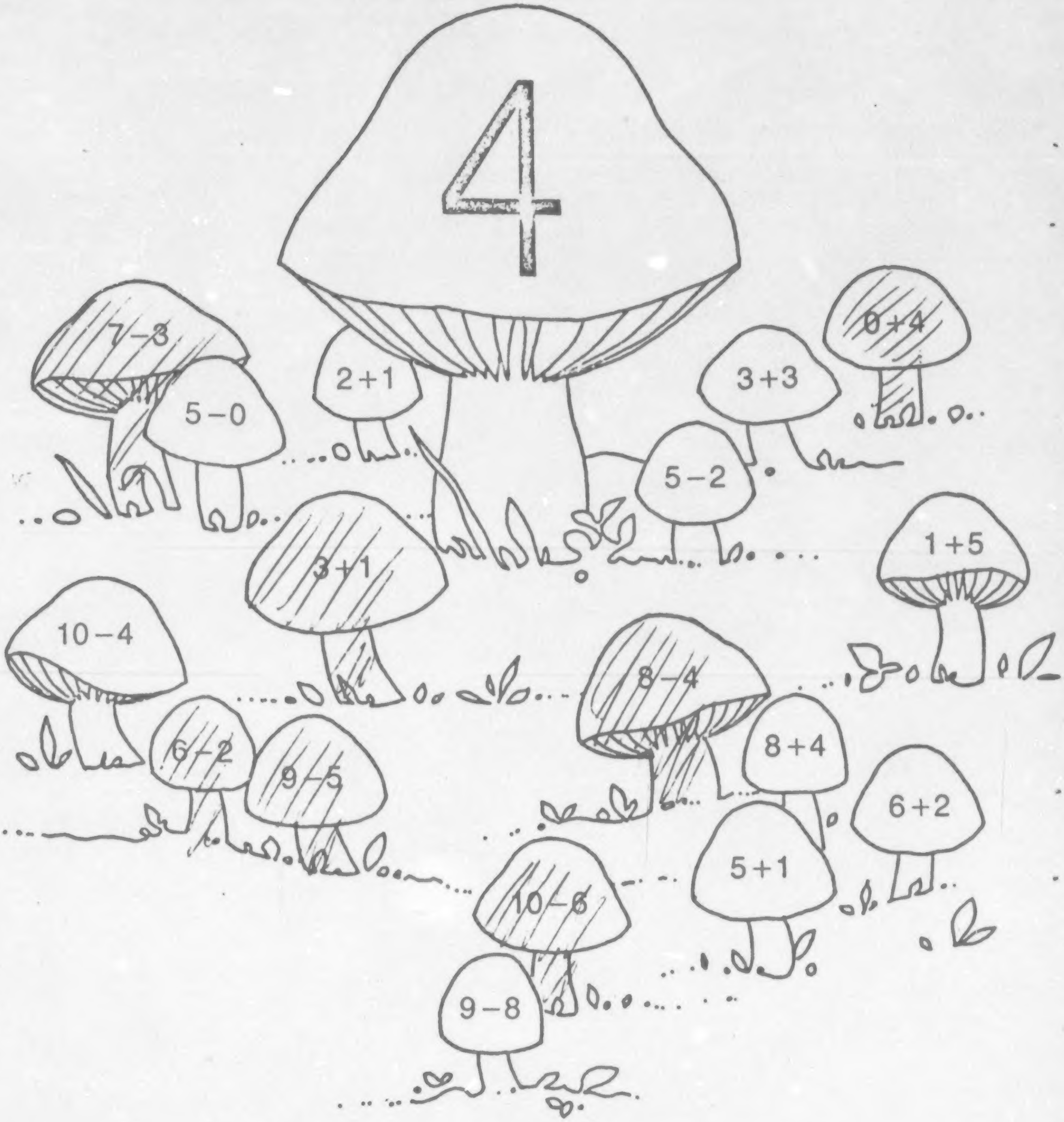
9 D's	3 D's	4 D's	? 3 D's

9
3
+ 4
16

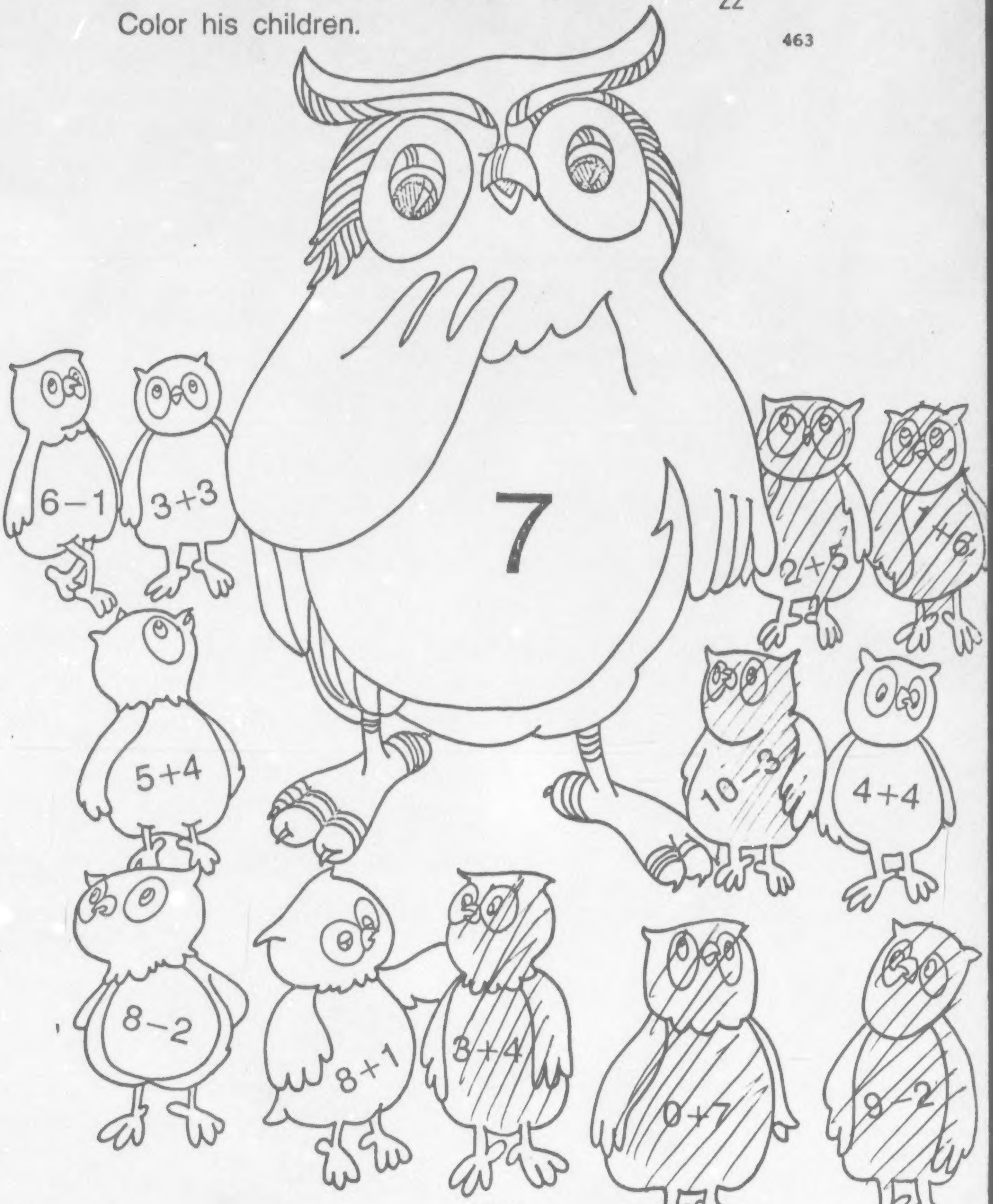
19
− 16
3 D's

Color Mother Mushroom's babies.

462 They have the same name she has.


4
7−3
2+1
0+4
3+3
5−0
5−2
3+1
1+5
10−4
8−4
6−2
9−5
8+4
6+2
5+1
10−6
9−8

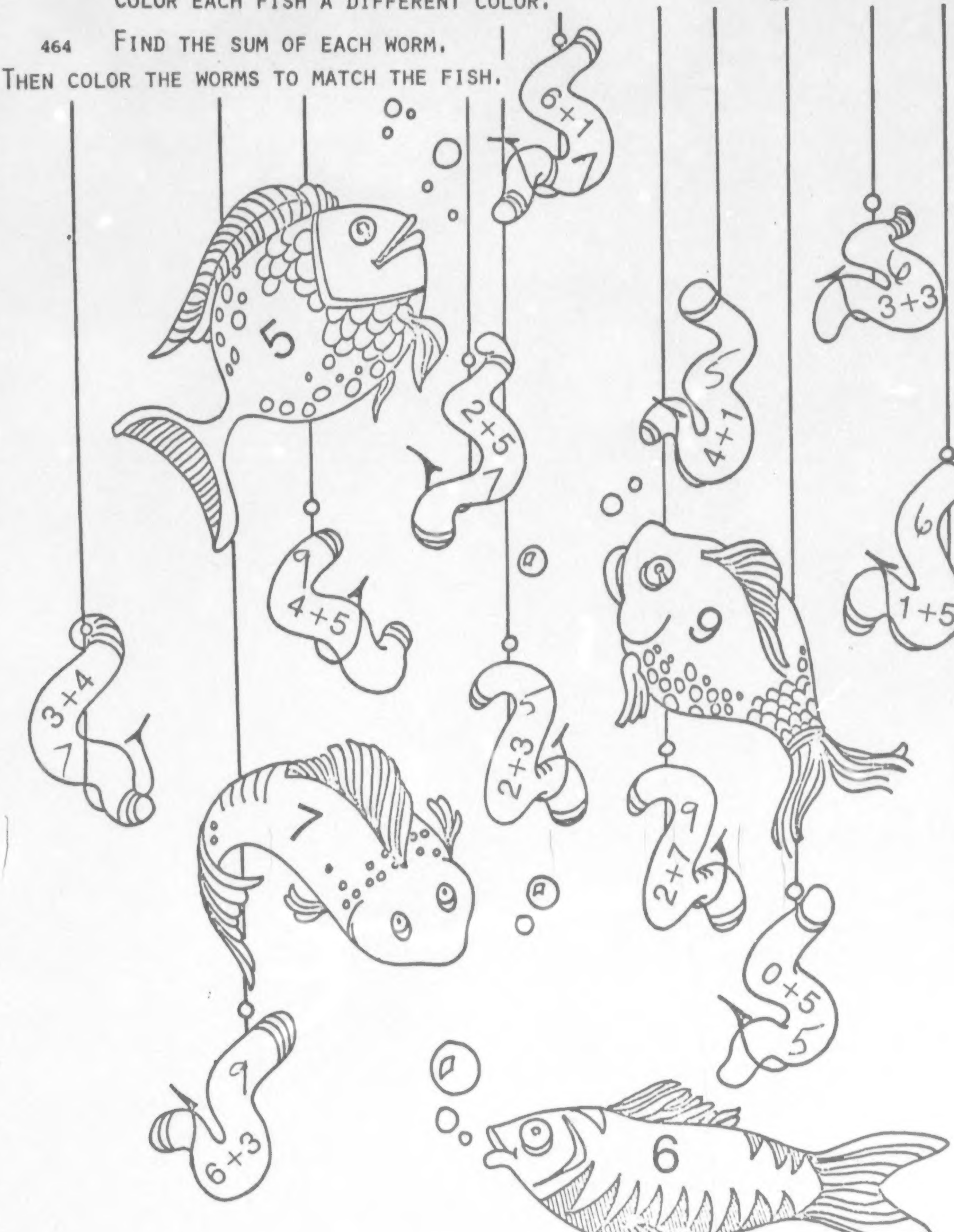
Father Owl's children
have the same name he has.
Color his children.


7
6−1
3+3
5+4
8−2
8+1
3+4
0+7
9−2
2+5
1+6
10−3
4+4

COLOR EACH FISH A DIFFERENT COLOR.

464 FIND THE SUM OF EACH WORM.

THEN COLOR THE WORMS TO MATCH THE FISH.

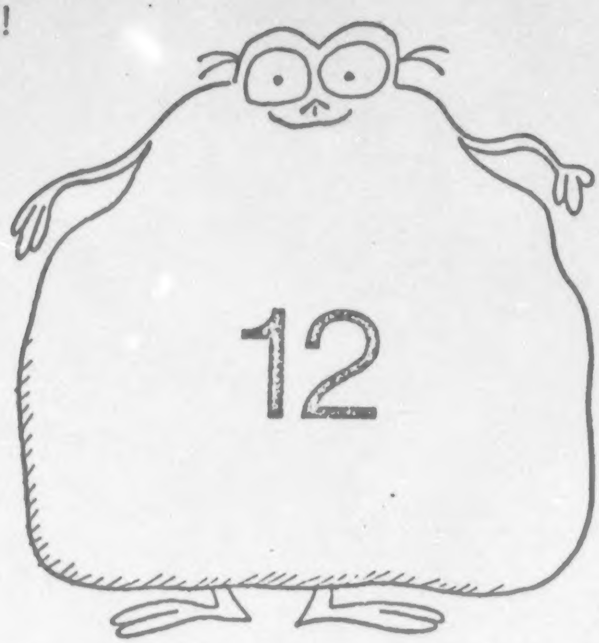

6+1
7
5
2+5
7
3+3
6
4+1
5
4+5
9
1+5
6
9
3+4
7
2+3
5
7
2+7
9
0+5
5
6+3
9
6

Write another name for the number.

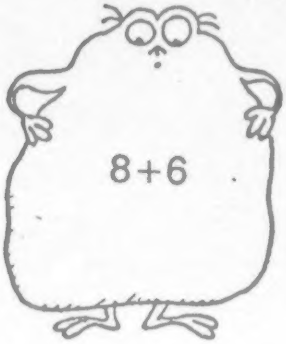
Only some answers are given. Others are possible.

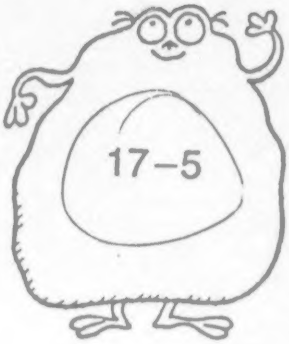
4+6	Example: 3+7
8+1	9, 10-1, 7+2, 3+6, 11-2, 5+4, 9+0, 12-3
10−3	7, 6+1, 5+2, 4+3, 11-4, 12-5, 7+0
5+5	10, 9+1, 8+2, 7+3, 6+4, 10+0, 11-1, 12-2, 13-3, 14-4
7−5	2, 1+1, 0+2, 2-0, 3-1, 4-2, 5-3, 6-4
7+3	10 see 5+5
4+4	8, 8-0, 7+1, 6+2, 5+3, 8-0, 9-1, 10-2, 11-3
1+2	3, 3+0, 2+1, 30, 5-2, 4-1, 6-3, 7-4
8+2	10
9−3	6, 6+0, 5+1, 4+2, 3+3, 6-0, 7-1, 8-2, 10-4

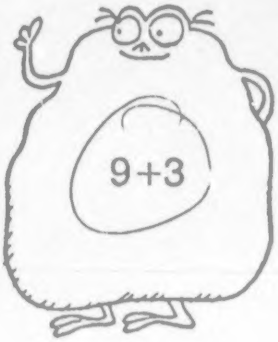
This a ZOX!

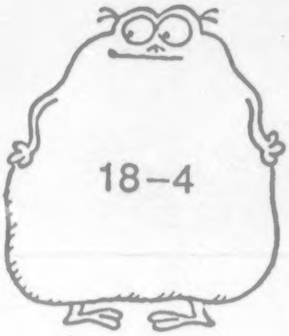


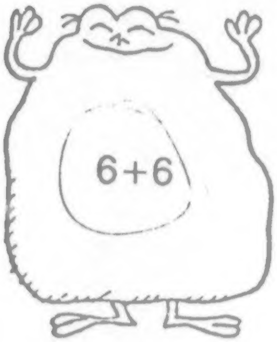
Which of these belong to this ZOX family?
Color them.

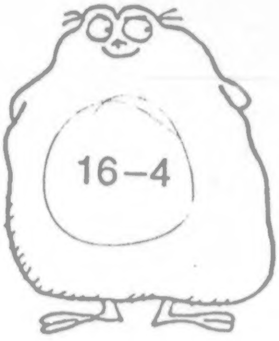


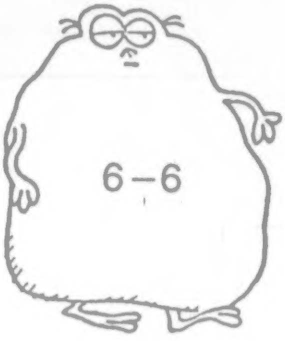


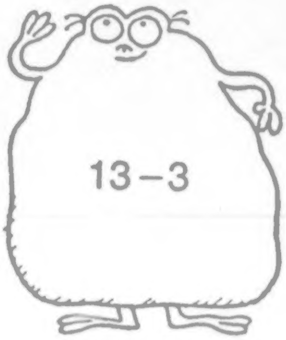


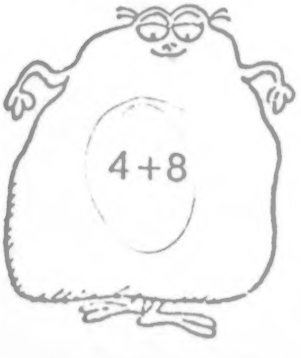


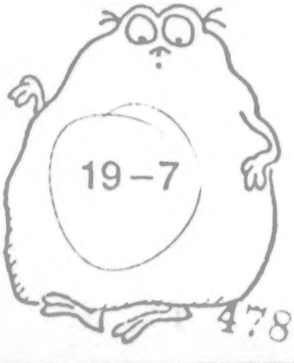


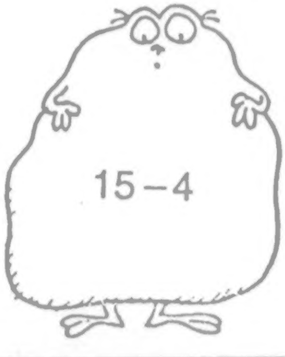


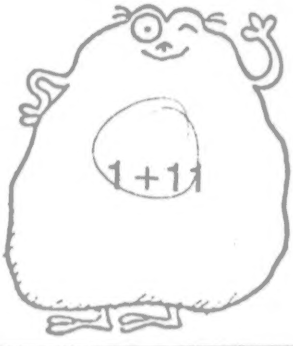




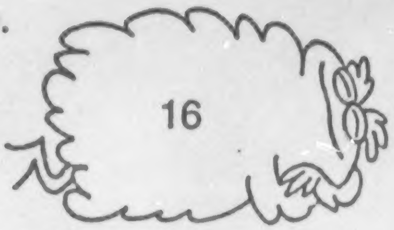




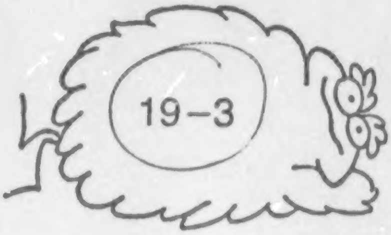


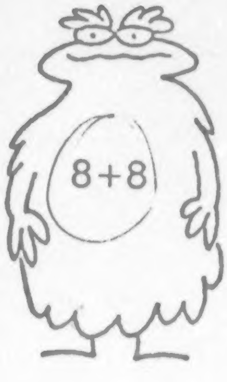


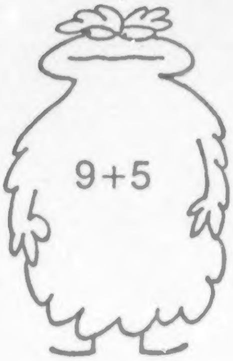
Meet Trixxle.

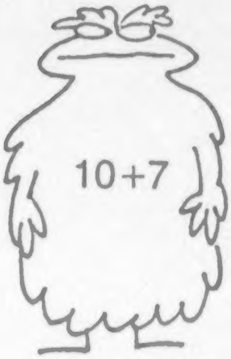


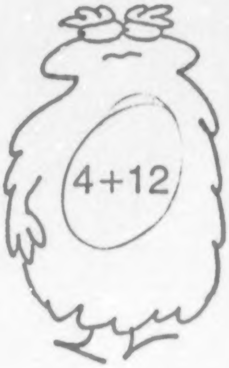
Find the other Trixxles!
Color them.

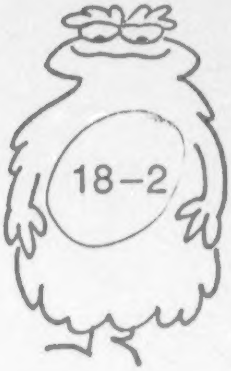




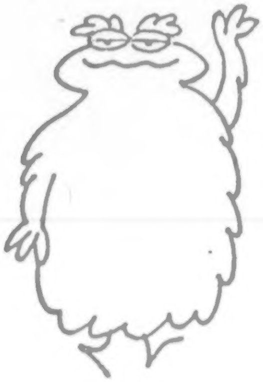


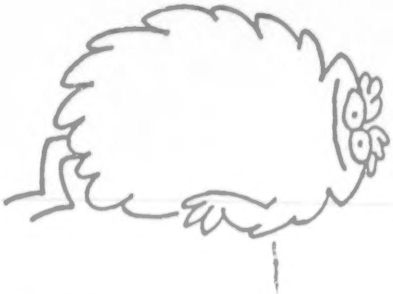


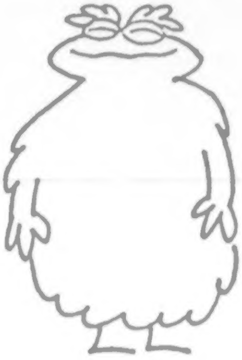


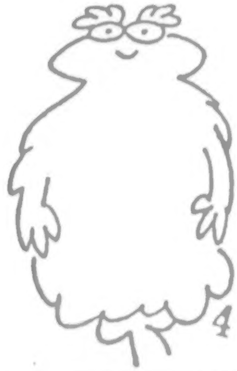


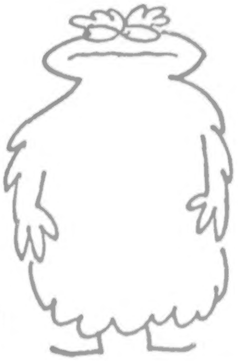
Make some more Trixxles!











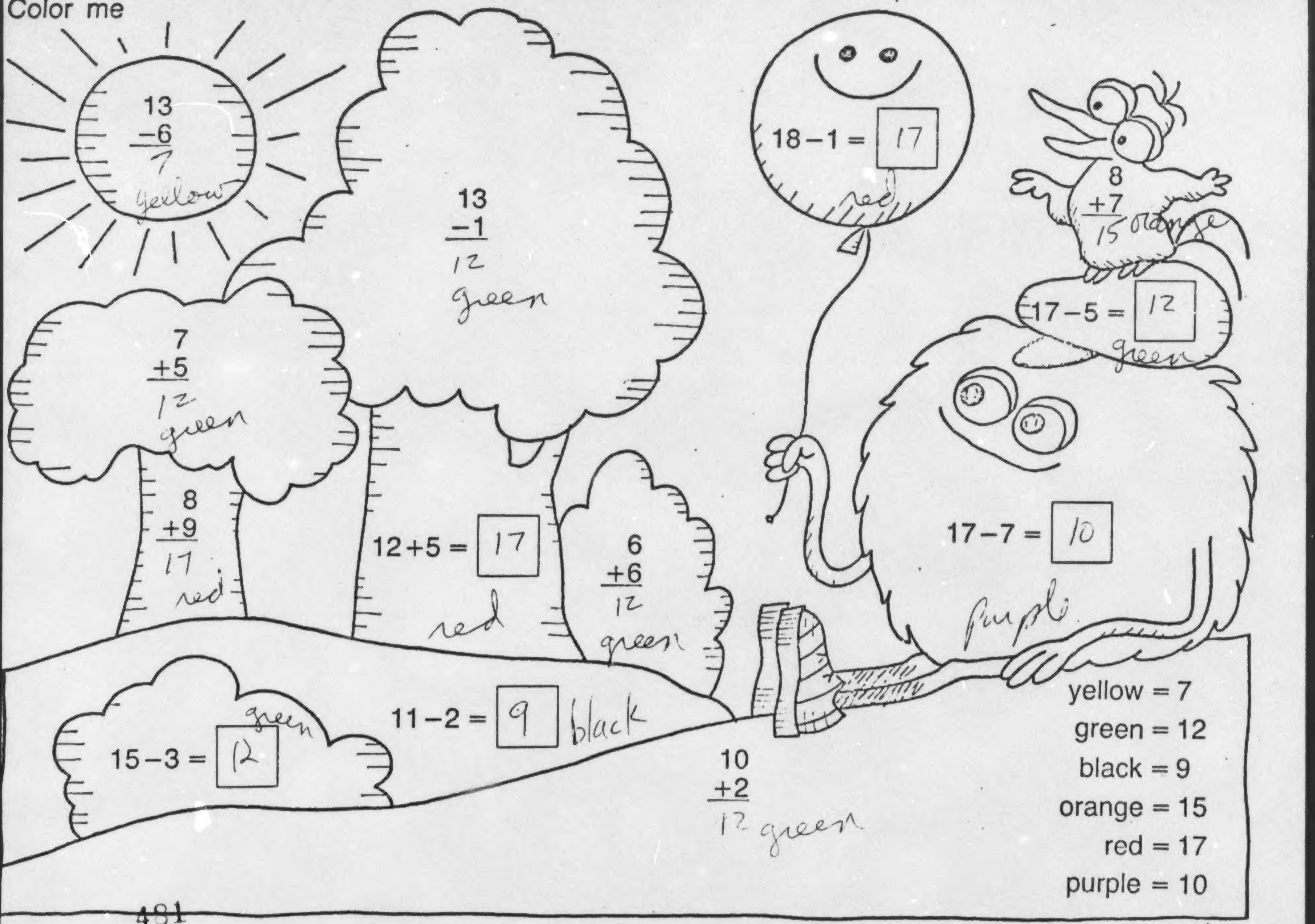
468

Circle the names for each number.

11	[✓ 4+7]	8−3	[✓ 15−4]
	[✓ 6+5]	[✓ 17−6]	18−8
13	9+5	[✓ 7+6]	[✓ 11+2]
	[✓ 16−3]	10−3	8+4
14	[✓ 12+2]	[✓ 17−3]	15−4
	[✓ 7+7]	[✓ 15−1]	3+10
15	[✓ 6+9]	7+7	[✓ 16−1]
	18−4	19−3	[✓ 7+8]
17	[✓ 14+3]	[✓ 9+8]	[✓ 19−2]
	18−2	20−4	11+7
19	[✓ 13+6]	20−2	[✓ 8+11]
	[✓ 20−1]	14+4	[✓ 2+17]

480

Color me



13
−6
7
yellow

13
−1
12
green

18 − 1 = 17
red

8
+7
15 orange

7
+5
12
green

17 − 5 = 12
green

8
+9
17
red

12 + 5 = 17
red

6
+6
12
green

17 − 7 = 10
purple

15 − 3 = 12
green

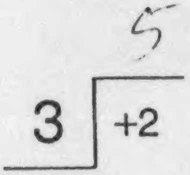
11 − 2 = 9 black

10
+2
12 green

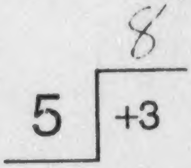
yellow = 7
green = 12
black = 9
orange = 15
red = 17
purple = 10

Write an answer for each stair.

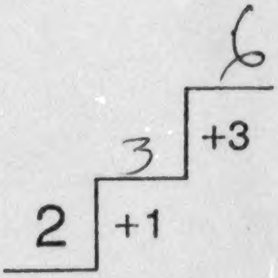
a



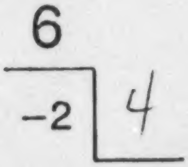
b



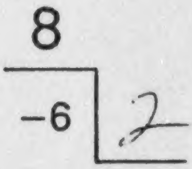
c



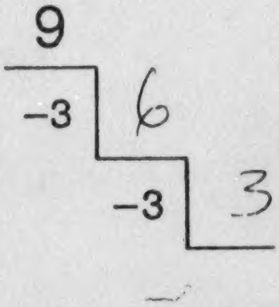
d



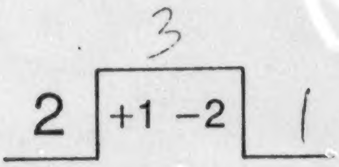
e



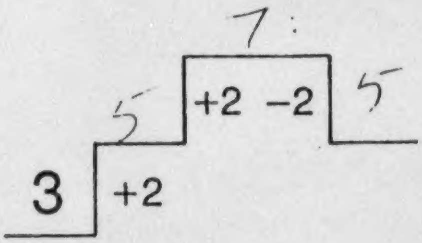
f



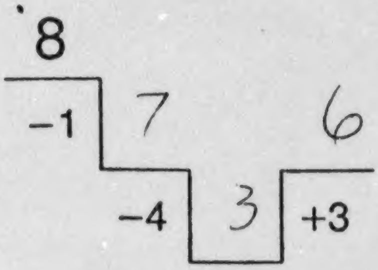
g



h

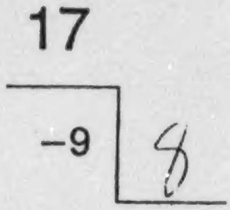


i



Number the stairs.

a



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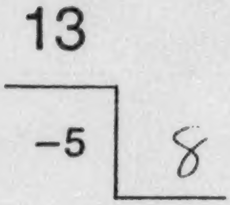
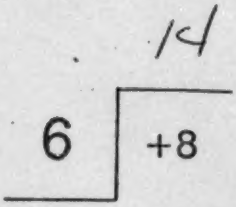
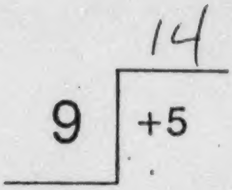


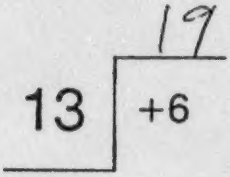
c



d



e



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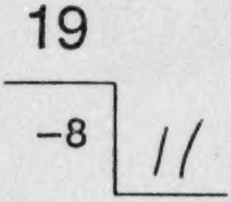
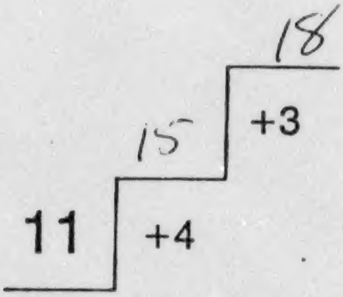


g



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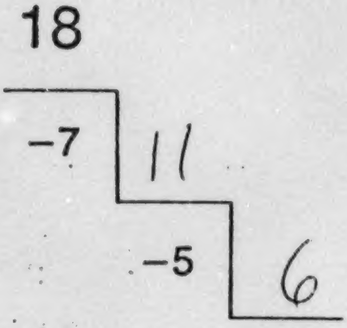
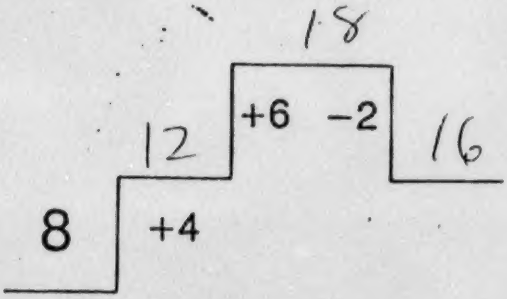
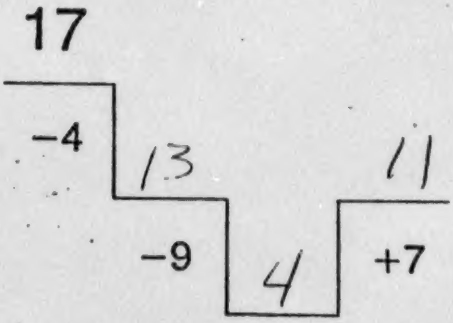


i


18
+6
−2
12
16
8
+4

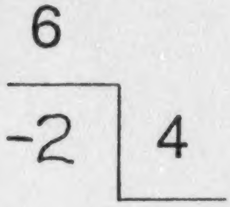
j


17
−4
13
11
−9
4
+7

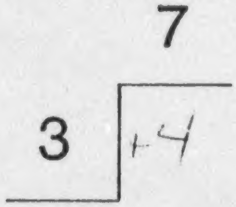
Find the missing number. 31

472

a Example:



b



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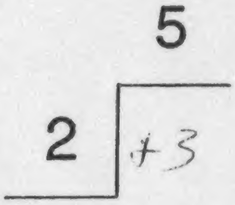

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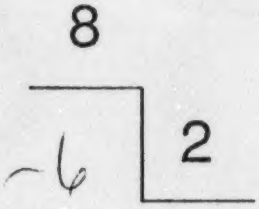
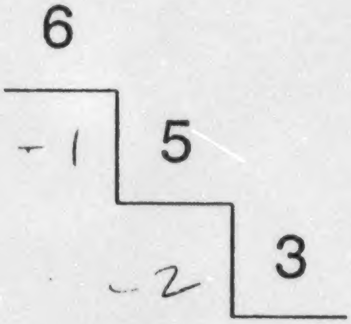


e



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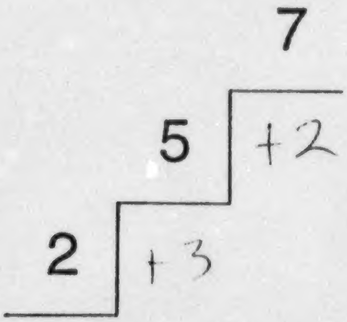

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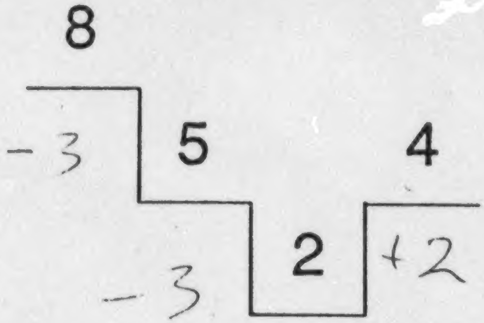
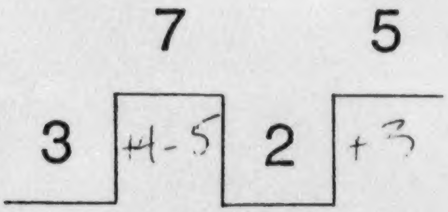


h



+

2	2	4
1	3	4
3	5	8

+

3	1	4
3	2	5
6	3	9

−

10	2	8
6	1	5
4	1	3

−

9	3	6
8	3	5
1	0	1

Number puzzles

474 Write the missing numbers.

+

12	4	16
2	1	3
14	5	19

−

17	3	14
8	0	8
9	3	6

−

14	4	10
7	1	6
7	3	4

+

10	3	13
6	0	6
16	3	19

Make your own.
Trade with a friend.

−

+

Use cubes to measure the distances
on your rectangle.

How far is it from A to E? ____ answers vary
Find some other distances
that are the same length.
____ to ____ , ____ to ____ , ____ to ____

How far is it from B to H? ____
Find some other distances
that are the same length.
____ to ____ , ____ to ____ , ____ to ____

How far is it from H to E? ____
Find some other distances
that are the same length.
____ to ____ , ____ to ____ , ____ to ____

How far is it from F to A? ____
Find some other distances
that are the same length.
____ to ____ , ____ to ____ , ____ to ____

How far is it from C to H? ____
Find some other distances
that are the same length.
____ to ____ , ____ to ____ , ____ to ____

Extra hard problem: 498
How far is it from G to F to H to E to G? ____

Use cubes to measure the distances on your rectangle.

answers vary

How far is it from B to H to D? ____ + ____ = ☐

How far is it from B to H to F? ____ + ____ = ☐

Which is longer? B to H to D or B to H to F?

Write a sentence to help find out how much longer it is. ________________________

How far is it from C to F to D? ____ + ____ = ☐

How far is it from C to I to B? ____ + ____ = ☐

Which is longer? C to F to D or C to I to B?

Write a sentence to help find out how much longer it is. ________________________

How far is it from G to C to F? ____ + ____ = ☐

How far is it from E to B to H? ____ + ____ = ☐

Which is longer? G to C to F or E to B to H?

Write a sentence to help find out 499
how much longer it is. ________________________

answers vary

Make a triangle with 7 counting sticks. Fill in the blanks in this sentence for the length of each side of your triangle.

7 = ____ + ____ + ____

Make a triangle with 6 sticks. Can you make the sides equal? ____ Fill in the blanks for the length of each side of your triangle.

6 = ____ + ____ + ____

Make a triangle with 10 counting sticks. Can you make the sides equal? ____ Fill in the blanks for the length of each side of your triangle.

10 = ____ + ____ + ____

Make a triangle with 9 sticks. Can you make the sides equal? ____ Fill in the blanks for the length of each side of your triangle.

9 = ____ + ____ + ____

Can you make a square with 4 sticks? ____ If you can, fill in the blanks for the length of each side of your square.

4 = ____ + ____ + ____ + ____

Can you make a square with 6 sticks? ____ If you can, fill in the blanks for the length of each side of your square.

6 = ____ + ____ + ____ + ____

Can you make a square with 8 sticks? ____ If you can, fill in the blanks for the length of each side of your square.

8 = ____ + ____ + ____ + ____

Can you make a rectangle with 6 sticks? ____ If you can, fill in the blanks for the length of each side of your rectangle.

6 = ____ + ____ + ____ + ____

478 Solve these sentences.

$3+\boxed{6}=5+4$

$7-4=\boxed{1}+2$

$2+\boxed{2}=8-4$

$\boxed{1}+1=6-4$

$4+\boxed{2}=9-3$

$\boxed{10}-2=1+7$

$4+4=\boxed{7}+1$

$9-5=6-\boxed{2}$

$8-\boxed{3}=4+1$

$\boxed{7}-1=8-2$

$6-\boxed{4}=4-2$

$3+6=9+\boxed{0}$

Fill in the box with $\neq$ or $=$. 38

$3+8 \boxed{\neq} 19-2$

$9+6 \boxed{=} 6+9$

$14-8 \boxed{\neq} 14-4$

$19-7 \boxed{\neq} 19-13$

$9+8 \boxed{\neq} 9-8$

$4+4 \boxed{\neq} 6+6$

$17-9 \boxed{\neq} 14-9$

$7+10 \boxed{=} 10+7$

$20-8 \boxed{=} 6+6$

$17--4 \boxed{\neq} 8+7$

$0+12 \boxed{\neq} 15+0$

$11+7 \boxed{\neq} 11-7$

$3+9 \boxed{\neq} 19-3$

$11+4 \boxed{\neq} 4+12$

$9+8 \boxed{=} 1+16$

Solve the sentences.

$\boxed{1} +8 = 16-7$

$11- \boxed{0} = 11+0$

$19-16 = \boxed{19} -16$

$8+6 = \boxed{6} +8$

$15-4 = 2+ \boxed{9}$

$14+ \boxed{2} = 11+5$

$9- \boxed{0} = 17-8$

$3+ \boxed{13} = 12+4$

$17-5 = \boxed{6} +6$

$20-10 = 11+ \cancel{\boxed{}}$

can't do

$9+ \boxed{5} = 12+2$

$13+ \boxed{7} = 7+13$

$\boxed{13} -11 = 4-2$

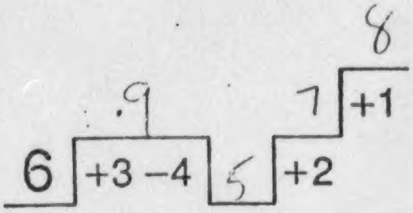
$\boxed{15} -6 = 15-6$

$13+ \boxed{6} = 16+3$

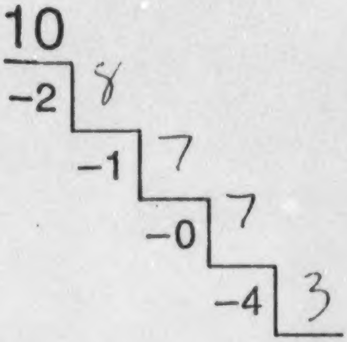
Write an answer on each stair.

480

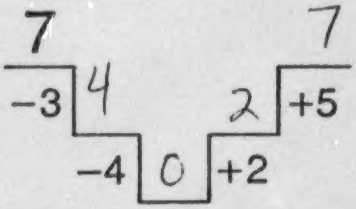
a



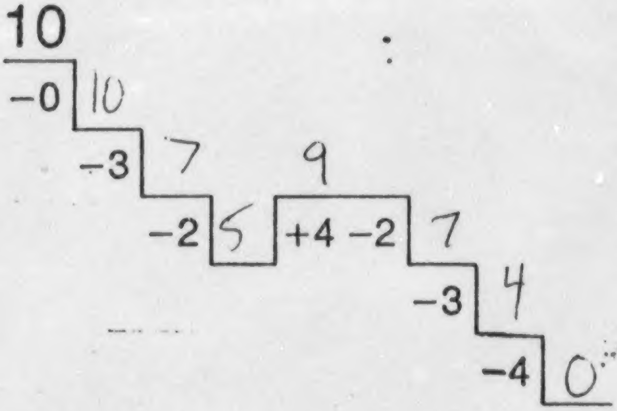
b


10
−2
8
−1
7
−0
7
−4
3

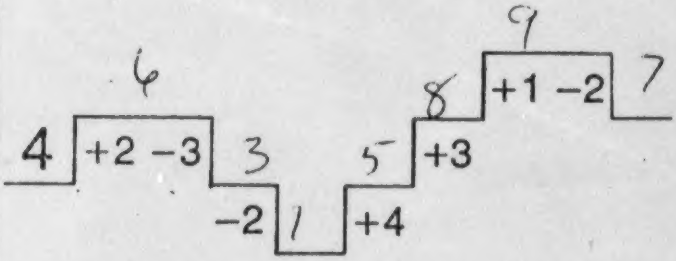
c



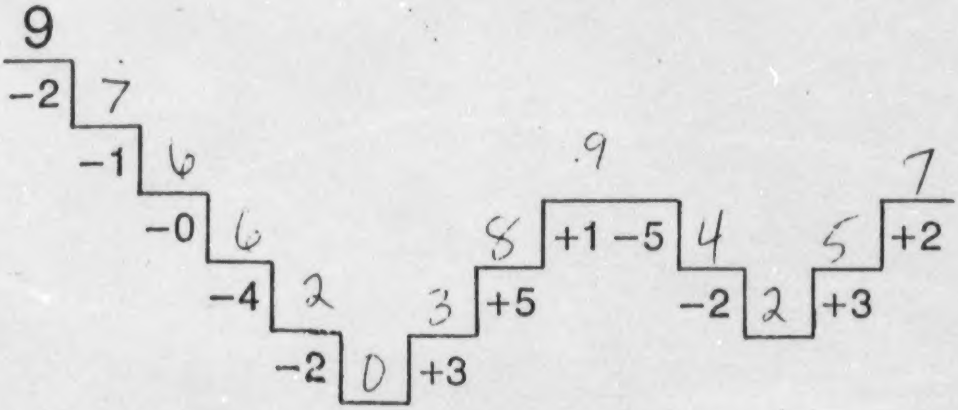
d


10
−0
10
−3
7
−2
5
+4
9
−2
7
−3
4
−4
0

e


4
+2
6
−3
3
−2
1
+4
5
+3
8
+1
9
−2
7

f


9
−2
7
−1
6
−0
6
−4
2
−2
0
+3
3
+5
8
+1
9
−5
4
−2
2
+3
5
+2
7

40

Look at the sentence at the top.
Look at the first number. If you put it in the first box, what number goes in the second box?

$\square + 3 = \square - 1$

first box	second box
0	4
1	5
2	6
3	7
4	8
5	9
6	10
7	11
8	12

$10 - \square = 6 + \square$

first box	second box
0	4
1	3
2	2
3	1
4	0

$\square + 3 = \square - 1$

first box	second box
3	7
4	8
5	9
6	10
7	11
8	12

$\square - 5 = 1 + \square$

first box	second box
0	no solution
1	
2	
3	
4	
5	
6	0
7	1
8	2
9	3
10	4

$\square + 5 = 15 - \square$

first box	second box
0	10
1	9
2	8
3	7
4	6
5	5
6	4
7	3
8	2
9	1
10	0
11	
12	
13	
14	no solution
15	
16	
17	
18	
19	
20	

$19 - 6 = \square + \square$

first box	second box
0	13
1	12
2	11
3	10
4	9
5	8
6	7
7	6
8	5
9	4
10	3
11	2
12	1
13	0
14	
15	no solation
16	
17	
18	
19	
20	

$\square - 3 = \square + 8$

first box	second box
0	
1	
2	
3	
4	no solution
5	
6	
7	
8	
9	
10	
11	0
12	1
13	2
14	3
15	4
16	5
17	6
18	7
19	8
20	9

42

Make an 8-rod.

Can you divide it into

halves? yes

thirds? no

fourths? yes

fifths? no

eighths? yes

Make a 9-rod.

Can you divide it into

halves? no

thirds? yes

fourths? no

ninths? yes

Make a 7-rod.

Can you divide it into

halves? no

thirds? no

fourths? no

sevenths? yes

Make a 10-rod.

Can you divide it into

halves? yes

thirds? no

fourths? no

fifths? yes

tenths? yes

Make a 12-rod.

Can you divide it into

halves? yes

thirds? yes

fourths? yes

fifths? no

sixths? yes

Make an odd rod.

Can you divide it into halves? no

Make an even rod.

Can you divide it into halves? yes

Make an 8-rod.
Divide it into halves.
How many cubes in
one-half? 4
two-halves? 8

Make a 9-rod.
Divide it into thirds.
How many cubes in
two-thirds? 6
one-third? 3
three-thirds? 9

Make a 10-rod.
Divide it into fifths.
How many cubes in
one-fifth? 2
two-fifths? 4
three-fifths? 6
four-fifths? 8
five-fifths? 10

Make an 8-rod.
Divide it into fourths.
How many cubes in
one-fourth? 2
four-fourths? 8
three-fourths? 6
zero-fourths? 0

Make a 12-rod and a 10-rod.
Divide each into halves.

Which is longer, one-half of the 12-rod or one-half of the 10-rod? 12-rod

Make a blue 6-rod and a red 6-rod.
Divide the blue 6-rod into halves.
Divide the red 6-rod into thirds.
Which is longer, one-half of the blue 6-rod or one-third of the red 6-rod? one-half of the blue rod

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